Framework for the integration of the project delivery team

FRAMEWORK FOR THE INTEGRATION OF THE PROJECT DELIVERY TEAM

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ABSTRACT

The challenge to the construction industry in the United Kingdom (UK) to improve its performance in the delivery of projects to levels more acceptable to clients continues to receive attention from both industry and academia. This is because recommendations of past industry reports and research have not been able to address the fragmented approach to project delivery, often cited as the primary cause of the industry's poor performance, and the resulting unreliable delivery times and cost overruns. Effective integration of the delivery team could improve team cultures and attitudes, and encourage the collaborative working necessary for improved project delivery performance.

This research aims to develop a framework for improving the integration of the project delivery team necessary for a more effective teamwork environment. The thesis begins with a review of the literature on project delivery and the concepts of team, teamwork and integration for performance improvement in multi-disciplinary environments. It explores, through interviews, how leading construction project managers have engendered and managed the integration of teams in large projects. A framework of working practices for improving the integration is developed from three live case studies. The framework is validated through industry-based workshops.

Exploratory interviews, conducted in the first phase of the research process provided empirical evidence of how integration could act as a means of improving teamwork. The results highlighted that parties that make up the delivery team operated within organisationally defined boundaries but acknowledged that working together would yield better results. The extent of their integration was influenced by team practices and the procurement approach. The Design and Build system provided the most conducive environment for team integration. Case studies, conducted in the second phase of the research, concluded that integration was more effective within individual organisations and was influenced within the project delivery team by its

structure and processes, work environment and culture. These issues had received attention individually, but this research established that they were interrelated. It proposes the comprehensive and structured approach to ensure effective integration.

The framework developed within the research provides project leaders with a holistic and structured approach for achieving efficient teamwork through the appropriate integration of the project delivery team throughout the construction period. Such knowledge is necessary for achieving any meaningful improvements in how the project delivery team works together as a single unit.

KEYWORDS: ***Construction Industry, Delivery Performance, Fragmentation, Integration, Project Delivery, Team, Teamwork***

DEDICATION

This thesis is dedicated

To the memory of my mentor

James Beau Nunoo Taylor,

and

my family

Yvonne, Audra and Jeremy Baiden.

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Now therefore, our God, we thank thee, and praise they glorious name.

(1 Chronicles 29:13)

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CHAPTER ONE - INTRODUCTION TO THE RESEARCH

1.1 INTRODUCTION

The construction industry in the United Kingdom (UK), a major contributor to the Gross Domestic Product (GDP), has been challenged in recent years to improve its performance in the delivery of projects to levels more acceptable to clients (Corporate Watch 2004; DTI 2004; Egan 1998; Latham 1994). This is because all too often delivery times are unreliable and costs overruns excessive. Profitability is consequently low and investment in research and development in the industry has been on the decline (Fairclough 2002). Improved project performance is thus required if the industry is to attract more work and investments (Egan 2002; Egan 1998; Fairclough 2002; Latham 1994).

The products of the construction industry are often large, complex and unique for both repeated and one-off clients (Hillebrandt 1985; Kwakye 1997). The procurement systems used usually involve a number of individually trained professionals and independently formed organisations that come together through a competitive selection process (Harris and McCaffer 2003; Masterman 2002; Morton 2002). However, these professionals and organisations need to be well integrated to work together as a single team within the relatively short period of construction and this presents a challenge to effective teamwork, especially within the on-site project delivery team.

This research, therefore, investigates how the delivery team, responsible for the design and construction of a project, can be integrated to work together more efficiently and effectively. The research focuses on exploring and structuring existing good integration practices to improve effectiveness of teamwork. The findings of the research provide project leaders, managers or directors (depending on company

and/or project structure) with a holistic and structured approach in achieving efficient teamwork through the effective integration of the project delivery team throughout the construction period.

This first chapter introduces the research. The chapter describes the background, study justification, key research questions, aim, key objectives, methodology and the achievements of the research. The outline of the chapters in this thesis is also presented in this introductory chapter.

1.2 RESEARCH BACKGROUND

The construction industry in the UK contributes to ten percent of GDP and offers employment to 1.6 million people (DTI 2004). The output of the industry ranks in the top ten of the world. The industry, which has often been used as an economic regulator is, therefore, significant and hence its performance more important (Corporate Watch 2004; Crosthwaite and Connaughton 2004; DTI 2004; Huru 1992).

However, project delivery performance within the UK construction industry has been criticised for being unreliable. Time and budget overruns are common and much effort and resources are invested in making good defects. Consequently, the industry also has low profitability and little investments in research and development to keep abreast with technological and process innovations seen in other industries such as manufacturing (Bourn 2001; Egan 1998; Egan 2002; Fairclough 2002; Latham 1994; Vyse 2001; Wyatt 1994).

One major cause of the poor performance of the industry is its fragmented approach to project delivery. This is because the various teams in the industry have not been able to work together as expected to deliver projects effectively (Egan 2002; Evbuomwan and Anumba 1998). The large and complex nature of construction projects, processes, teams, and interested parties have made the integration more difficult to achieve within the relatively short period that projects normally last. The industry also still continues to use procurement practices that do not encourage teams to work together effectively and efficiently (Love and Gunasekaran 1998).

The fragmentation of the project delivery process has been blamed on the traditional separation of the design and construction processes. The selection of the professional teams on a price-based competition without attention to their ability to work together with other teams on the project has also contributed to the fragmented delivery process (Cornick and Mather 1999; Huru 1992; Morton 2002). The construction industry is, therefore, characterised by individualistic approaches and adversarial relationships which have resulted in lack of transparency and trust within the project delivery team environment. The various functional and disciplinary teams tend to blame each other in an attempt to minimise their level of exposure to usually, financial consequences, from unacceptable performance. The result is Client dissatisfaction with the delivered products of the industry (Egan 2002).

The industry has responded to these criticisms by introducing a number of improvement techniques and tools. Many industry-led reports (Bourn 2001; Egan 1998; Egan 2002; Latham 1994; Strategic Forum for Construction 2003) have all called on the industry to change from its traditional modus operandi and perform better through increased collaboration. Recent follow-up reports such as the Accelerating Change (2002), challenged the UK construction industry to create a fully integrated service capable of delivering predictable results to clients through processes and team integration. The Integration Toolkit, developed in 2003 by the Strategic Forum for Construction on the recommendations of the Accelerating Change report, provided a guide to superior delivery performance and value for all project stakeholders by replacing the fragmented and contractual relations that have often resulted in sub-optimal performance with collaborative working and repeat long-term relationships.

These attempts have not achieved the expected success because they have been superimposed in an environment where the culture and attitude of adversity still exist (Moore and Dainty 1999). However, the collectivist nature of construction activities and the number of distinctive roles in a project means success will depend largely on how the various teams and roles can be pulled together (Moore and Dainty 1999). A construction project site is, therefore, an environment where pulling various

expertises together is fundamental to success (Brannick and Prince 1997; Cornick and Mather 1999).

1.3 RESEARCH JUSTIFICATION

1.3.1 ASPIRATION OF THE UK CONSTRUCTION INDUSTRY

The realisation of an integrated project delivery team working together as a single unit still remains an aspiration within the UK construction industry. The various parties within the delivery team continue to work as individual units. Recent calls for the integrated project delivery processes and teams in the UK construction industry indicate that teamwork within the industry is not as effective and efficient as expected (Egan 2002; Lennard et al. 2002; Payne et al. 2003; Strategic Forum for Construction 2003).

Clients are still looking for improved performance throughout the industry. There is the need for increased efforts geared at improving the anticipated level of satisfactory product delivery of the industry. Continued achievement of satisfactory performance is necessary to increase the confidence of clients from the prevailing unacceptable level of product delivery performance of the industry. Construction firms could then attract more work and deliver them efficiently and profitably. This is critical for the future survival of firms from the business perspective through adequate returns on investments (Crane 2002; Wyatt 1994).

1.3.2 RESEARCH INTO EFFECTIVE TEAM INTEGRATION

Teams are used in organisations in most sectors and industries due to the recognition that they are able to outperform individuals acting alone, especially when performance requires multiple skills and judgements. The focus on teams has increased because they are now accepted as basic units of working life. Teams also provide an avenue for satisfying the basic needs of people within the working environment, a phenomenon that is becoming increasingly important to employees (Maslow and Frager 1987). Their use has subsequently led to increased productivity and improved product quality in multi-functional environments, which are similar to

the construction industry (Conti and Kleiner 1997; Glassop 2002; Guzzo and Dickson 1996; Steward and Barrick 2000).

Construction work is performed by a number of multidisciplinary and multifunctional teams. The teams must work together with a common objective and to the satisfaction of the client who pays for their services. Construction work sections are also organized and carried out by teams with similar skills. The presence and use of teams in construction makes it an appropriate environment to explore the use of teams for performance improvement. Team integration efforts and techniques can, therefore, be harnessed for arguably improved project delivery process of the construction industry (Bender and Septelka 2002; Brannick and Prince 1997; Doorewaard et al. 2002).

Integration of teams within construction has been suggested by industry reports as a potential approach to improved performance (Egan 1998; Egan 2002; Strategic Forum for Construction 2003). However, there has been very little research on how these teams can be integrated. The focus, over the years, have been on improving the processes within individual teams (Anumba et al. 2002; Austin et al. 2002; Love and Gunasekaran 1998). Existing examples of team integration (Strategic Forum for Construction 2003; Vyse 2001) have been those implemented by major clients within industry as a way of improving project delivery throughout their supply chain. Past research has, however, not covered how the various teams can be integrated into a single unit. Gaps in knowledge exist on how the various teams on site that are responsible for delivering a project can be integrated.

1.4 RESEARCH QUESTIONS

A team is a group of people who must cooperate with each other to accomplish a given task. The purpose of a team is, therefore, to work together with complementary skill to achieve more than what can be achieved individually (Belbin 1996; Doorewaard et al. 2002; Payne et al. 2003; Steward and Barrick 2000).

Teamwork is the cooperative and coordinated efforts of individuals working together in the interest of their common course. It requires the sharing of knowledge and

information which occurs at the interface of problem solving and decision making (Drew and Coulin-Thomas 1996; Katzenbach and Smith 1993; Kirchmann and Hauschild 2001; Nurmi 1996; Stot and Walker 1995). The existence of teamwork is often taken for granted because it is assumed to be the core concept of team formation. This attitude has affected both effectiveness and efficiency of the concept, especially in multidisciplinary environments such as construction.

The effectiveness of teamwork is, however, dependent of the level of synergy among the members. This is at the core of teamwork concept and ensures that all team members contribute to the nurturing of a positive environment. Flexibility of team members to adapt to working in a cooperative atmosphere becomes central and leads to the achievement of goals through collaboration rather than competition (Ingram et al. 1997; Tarricone and Luca 2002)

Construction activities are performed by people with different skills within and across organisations who must share knowledge for optimum decisions. The activities of these organisations, individuals, and groups of individuals are also coordinated to ensure an orderly flow of work schedules. This means that teamwork is not an option but a prerequisite within the construction project environment for the successful delivery of a project (Baker and Salas 1997; Guzzo and Dickson 1996; Harris and Harris 1996; Samuel 1996; Steward and Barrick 2000). Effectiveness of teamwork thus needs to be improved.

The continued existence of confrontational attitudes and individual approach to work instead of collective and collaborative has affected the effectiveness of teamwork and consequently, the efficient delivery of construction projects (Alshawi and Faraj 2002; Faniran et al. 2001; Moore and Dainty 2001; Payne et al. 2003). This is because the success of a construction projects depends on how well the various teams share knowledge to arrive at optimum decisions. Effective integration is, therefore, required for efficient performance of the project delivery team.

Integration has been used in the construction industry, to describe the concept of freely exchanging information between different participants in the construction

process (Vincent and Kirkpatrick 1995). It allows for the merging of different disciplines with different goals, needs and culture into a cohesive and mutually supporting unit encouraged to undertake a single task through sharing and exchange of information to achieve a common goal (Austin et al. 2002; Howell 1996; Jaafari and Manivong 1999). Integration, therefore, gives the opportunity to incorporate several projects into a single structure. It encourages collaborative working and continuous improvement of team cultures and attitudes of professionals from different organisations and backgrounds working to overcome structurally or culturally determined interfaces (Love and Gunasekaran 1998; Moore and Dainty 1999).

The key questions posed in this research, therefore, are:

1. **what are the key factors that influence the integration of the project delivery team? and**
2. **how can the integration of the project delivery team be improved for the efficient delivery of a construction project?**

The research questions are focused on the project delivery team that is based on site and responsible for the design and construction of the project. This is because the most confrontation among the various team become very evident at the implementation stage where designs are translated into reality.

1.5 AIM AND OBJECTIVES

1.5.1 AIM

The research aims to develop a framework for improving the integration of the project delivery team. The framework will provide a more holistic and structured approach to engendering a more effective teamwork environment. It will comprise practices and processes that must be encouraged and/or avoided to improve the level of effective integration and collaborative working.

1.5.2 OBJECTIVES

The following research objectives have been developed to achieve the aim of the research outlined in Section 1.5.1 above:

Objective 1 review the performance of project delivery within the UK construction industry and improvement efforts;

Objective 2 review the concepts of team, teamwork and integration for performance improvement in multi-disciplinary environments;

Objective 3 identify how leading construction project managers have engendered and managed the integration of teams in large projects;

Objective 4 explore effective integration of the project delivery team through the investigation of three live case study projects managed by leading construction project managers;

Objective 5 develop a framework of working practices for improving the integration of delivery teams in future projects; and

Objective 6 validate case study findings and framework through industry-based workshops.

1.5.2 RESEARCH TARGET AND SCOPE

This research is targeted at team leaders at project, organisational and functional levels. The research findings and conclusions provide an understanding of factors that influence the effectiveness of integration of the project delivery team within a construction project. Such knowledge is necessary for achieving any meaningful improvements in how the project delivery team works together as a single unit.

The research was conducted within the scope of on-site delivery team of the project supply chain. This is the team responsible for the management of the design and construction of the project.

1.6 RESEARCH PROCESS

The approach adopted for this research is discussed in detailed in Chapter Four. The discussion includes the research strategy, design and method. A brief description and a flow diagram of the research process are presented below in this section and Figure 1.1 respectively.

An exploratory literature review was carried on the performance of projects within the construction industry in the UK. The review indicated poor performance that can be addressed through effective use of teams. An in-depth review of teams and their integration for performance improvement was then undertaken. The research questions were developed from these two literature reviews. The research aim and objectives were then established and an appropriate research strategy and methods selected.

Semi-structured interviews were conducted with award winning construction project managers to explore industry examples of how teamwork has been effectively engendered on large construction projects. Details and analysis of the interviews are presented in Chapter Five. The conclusions of the interview provided the basis for the selection suitable case studies were selected to identify the key issues affecting team integration.

Three live case study projects at various stages of progress were selected for observations. The objective was to explore integration practices and effective team working in live situations on project sites. The findings are presented in Chapters Six and a cross-case analysis of key integration issues in Chapter Seven. Chapter Eight discussed the development and validation of a framework is to improve the integration of the project delivery team. The research conclusions and the limitations that necessitate recommendations for future research are presented in Chapter Nine.

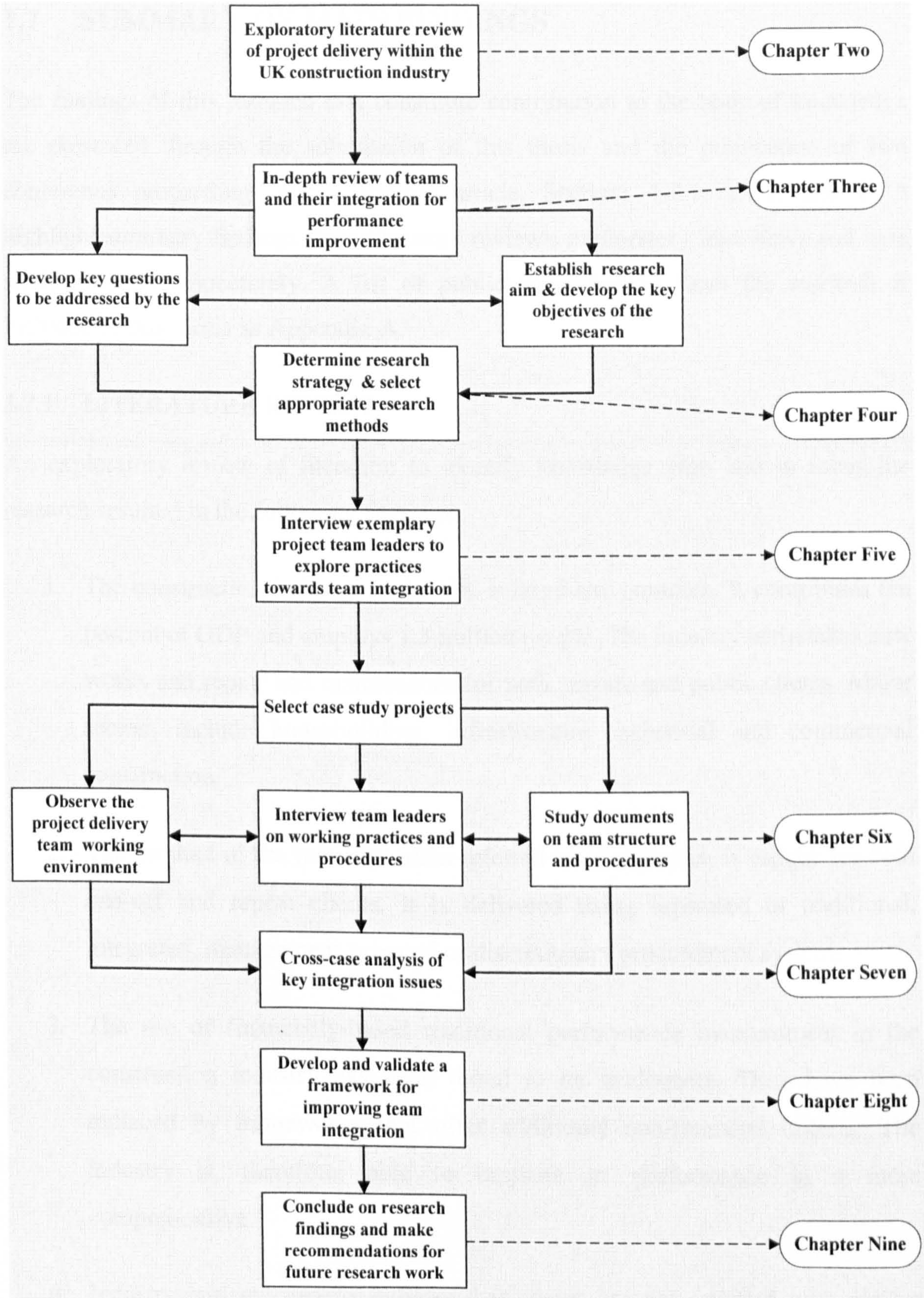

Figure 1.1 Flow diagram of research process.

1.7 SUMMARY OF MAIN FINDINGS

The findings of this research that constitute contribution to the body of knowledge are presented through the submission of this thesis and the publication of two conference proceedings and a journal article. Sections 1.7.1, 1.7.2, and 1.7.3 highlight summary findings from literature reviews, exploratory interviews and case study projects respectively. A list of publications derived from the research is included in this thesis as Appendix A.

1.7.1 LITERATURE REVIEW

An exploratory review of literature to identify knowledge gaps and to focus the research resulted in the following findings.

1. The construction industry in the UK is large and complex. It contributes ten percent of GDP and employs 1.5 million people. The industry undertakes new works and repair and maintenance for both private and public clients. Major sectors include housebuilding, infrastructure, industrial and commercial construction.

2. The product of the industry, often referred to as a project, is unique for both one-off and repeat clients. It is delivered using separated or traditional, integrated, management-oriented or discretionary procurement system.

3. The use of financially-based traditional performance measurement in the construction industry has been found to be inadequate. They have been replaced by frameworks that offer additional non-financial criteria. The industry is, therefore, able to measure its performance in a more comprehensive.

4. Industry-initiated reports indicate that clients are not satisfied with project delivery within the construction industry. The poor delivery performance has been attributed to fragmented project procurement and delivery process. The reports and past research have all called for the encouragement of

collaborative working practices and non adversarial attitudes through the formation of integrated project teams and processes.

The findings from the exploratory literature review led to additional research on the use of teams in other industries to highlight benefits that had been derived. The appropriateness of the construction as an industry to justify the use of teams to improve performance was then examined. The following summarises the main findings from the in-depth literature review.

1. Teams have become the basic building blocks of most multi-skilled environments within organisations because they are able to outperform individuals acting alone. An effective team has a high output, clear objectives, high energy and an appropriate structure with a conducive atmosphere.

2. Teamwork is a synergetic process required to engender information sharing and co-ordination of activities within a team. It increases efficiency and productivity of an organisation and skills and knowledge sharing among individuals. For teamwork to be effective, as in high performance teams, members have to adapt to working in a co-operative environment where goals are achieved collaboratively rather than through competition.

3. Construction work is carried out by multidisciplinary teams who come together over a relatively short period of time. Success, therefore, depends on well the various teams are work together as a single unit towards achieving the project goals. This can be achieved through integration which brings together different functional disciplines and in construction, leads to the free exchange of information among project participants.

In order to identify examples of good team integration for the delivery of construction projects and explore the conditions necessary for effective teamwork, exploratory interviews were conducted. Details of the interviews are presented in Chapter Five. A summary of finding is however presented in Section, 1.7.2

1.7.2 EXPLORATORY INTERVIEWS

In-depth exploratory interviews were conducted with nine of the twelve winners of the Construction Manager of the Year Award (CMYA) top category by the Chartered Institute of Building (CIOB) between 2000 and 2003. The following were the findings.

1. The various parties in the project team operate as individual competent groups within their own organisational defined boundaries but acknowledge that working together will yield better results.

2. The early formation of relationships enhances collaborative and integrated working within the project team and leads to an improved level of trust, removal of adversarial attitudes, and the creation project culture with a common goal.

3. The extent of team integration is influenced by the practices adopted within the team and their congruence with the procurement approach, level of trust, transparency, collective responsibility, achievement and a sense of ownership and pride.

4. Design and build arrangement, provides the best environment for the project team to work together to deliver a product. The central role of the contractor makes it more feasible to bring the various teams, which traditionally operate as separate groups, together as a single unit responsible for design and construction.

Three large design and build projects were selected for further study to explore the relationships and the interactions within and across the construction project delivery team. This is because conclusions from the exploratory interview indicate that design and build procurement offers the best environment for the integration of the delivery team. The selection of the project was on the basis of exploring integration practices within the best possible environment. The perceptions and understanding of teamwork among individual members of the project team were examined.

1.7.3 CASE STUDIES

The selected case study projects explored and examined individual and collective attitudes and behaviours within the project delivery team that promote or undermine collaborative working. Details of the case study projects are provided in Chapter Six of the thesis. The findings include the following.

1. Integration is more effective within individual organisational and functional teams. Very good examples of accessible leadership, friendly working environment, dissemination and distribution of project information, appropriate organisation and office structure exist within these teams.

2. Integration of the project delivery team is influenced by three key issues, namely team structure and processes, the work environment and culture. These issues were found to be inter-related and had to be looked at collectively to improve the level of teamwork effectiveness.

3. The key issues affecting the integration of the various teams that deliver a project have received attention but only separately, and there was no comprehensive strategy to link them. There was no structured approach in engendering an effective teamwork atmosphere.

4. Adherence to contractual details and commercial considerations were unnecessarily strong and mostly undue. That has affected the level of trust and transparency, which are necessary for effective integration and consequently, teamwork within the project delivery team.

5. The level of co-operation, collaboration and willingness to accept blame and changes in design reduced with increasing project progress. Teams were more relaxed and communicated more at the early stages but as the project progresses, the teams increasingly became more defensive and protective of their own interest.

1.7.4 FRAMEWORK

A framework of key issues identified throughout the case study projects as affecting the integration of the project delivery team was developed and validated in three separate focus groups. Each group comprised leaders of the various teams that make up the project delivery team. These leaders collectively agreed that the framework:

1. adequately highlighted key issues affecting the integration of the project delivery team. The strategies and practices suggested within the framework for improving the integration of the project delivery team were already in place with on-going projects;

2. provided a sufficient basis for the assessment of the extent of integration and a sense of the level of teamwork effectiveness within both their individual and project teams was based on the current practices and procedures; and

3. was easy to follow and understand. It provided the basis for future research on integration and teamwork measurement. Implementation and commitment to the framework by senior management could, however, take time. This was expected in an industry which has struggled over the years to accept fully embrace changes.

1.8 THESIS STRUCTURE

The thesis comprises an introduction, review of related literature, research design and method, exploratory interview, case studies, framework development and conclusions which form the basis for contribution to knowledge.

Chapter One is an introduction to the research. The background and justification for undertaking the research are presented in the chapter. The key questions for the research are posed, leading to the statement of the aim and the objectives. The chapter briefly describes the research process (detailed discussion follows in Chapter Four) and summary of achievements. An outline of the thesis is also presented.

Chapter Two reviews the project delivery performance within the UK construction industry. It presents the structure of the industry and its significance. The nature of product and the methods for delivering projects are highlighted. Performance measurement frameworks incorporating additional criteria to traditional financially based techniques are discussed. The performance of project delivery within the UK construction industry and attempts to bring them to acceptable level are highlighted through reports from industry-led initiatives.

Chapter Three reviews the role and importance of teams in organisations and how they can be integrated for improved performance. It defines and distinguishes between a group and a team. Team formation and roles within the team are reviewed. The concepts of teamwork and integration are introduced and their suitability to the construction project delivery environment is discussed. The chapter concludes on further research that needs to be conducted on team integration for improved project delivery.

Chapter Four describes the approach and discusses the methods used in achieving the objectives for the research. The implications and concerns on the choice of exploratory interviews, case study approach, and framework validation approach were also justified. Methods and techniques used in data collection, analyses and interpretation are presented.

Chapter Five presents exploratory industry-based interviews with award-winning construction project managers. The chapter details projects managed by the award winners. Data from the interviews, analyses, and discussion of factors influencing the integration of the project delivery team are also presented in the chapter. The chapter concludes with the justification for the selection of case study projects.

Chapter Six describes the case study projects and the project teams. Findings from data collected through observations, interviews and documentation are presented in the chapter. The chapter concludes on the practices identified on each project that affect the integration of the teams delivering the projects studied.

Chapter Seven presents a cross-case analysis and discussion of the key issues affecting team integration to address the key research questions. Key themes are identified from literature and the findings of exploratory interviews. The mains issues that emerge from the key issues are analysed across the three case studies. A summary of findings and the implications are also presented in the chapter

Chapter Eight presents the development of a framework for integrating the project delivery team. The need for the framework, an overview and the components of the framework are discussed. The chapter also presents validation and discussion of the framework.

Chapter Nine presents the main conclusions of the study and the achievement of the key research objectives. The contributions to research and implications of the conclusions on how to improve the integration of future project delivery teams are discussed in the chapter. The limitations of the research are also presented in the chapter to highlight potential areas for future research.

Appendices comprise additional relevant information on the research that cannot be included in the main body of the thesis.

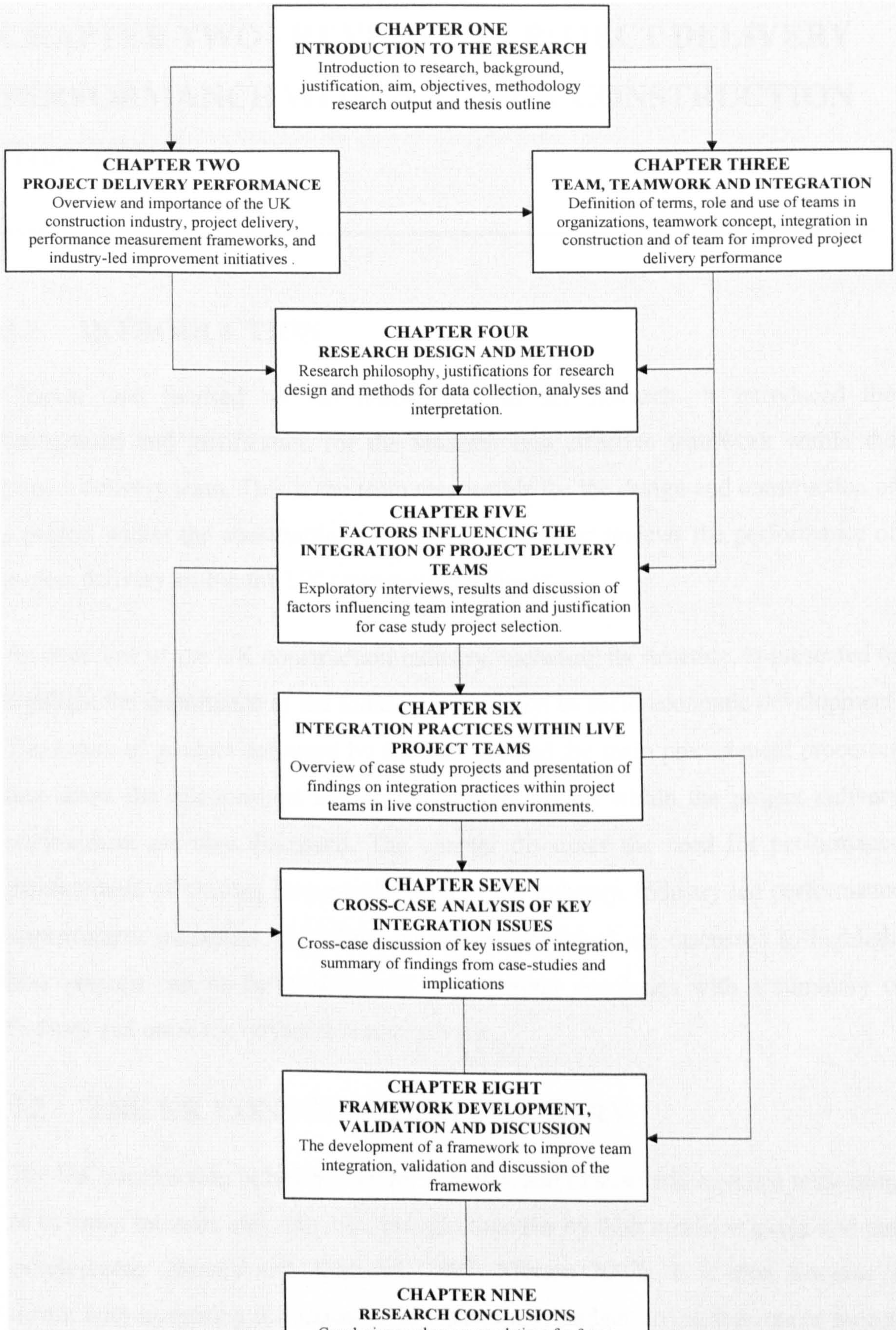

Figure 1.2 Outline of thesis

CHAPTER TWO - REVIEW OF PROJECT DELIVERY PERFORMANCE WITHIN THE UK CONSTRUCTION INDUSTRY

2.1 INTRODUCTION

Chapter One focused on the introduction to the research. It introduced the background and justification for the research into effective teamwork within the project delivery team. This is the team responsible for the design and construction of a project within the construction industry. This chapter reviews the performance of project delivery within the UK construction industry.

An overview of the UK construction industry, including its structure, is presented to highlight the importance of the industry, especially, to socio-economic development. The nature of product delivered by the industry and the main procurement processes that shape the relationships among the various parties within the project delivery environment are also discussed. The chapter discusses the need for performance measurement of existing frameworks used in the industry. Industry-led performance improvement initiatives and follow up reports published are discussed to highlight how projects can be better delivered. The chapter concludes with a summary of findings and areas for further literature review.

2.2 THE UK CONSTRUCTION INDUSTRY

The UK construction industry is large, complex and diverse and covers a wide range of business interests and activities, brought together by their common usage and land development (Harvey and Ashworth 1997; Morton 2002). It is also dynamic in nature with increasing uncertainties in technology, budget and development process (Chan *et al.* 2004). The industry comprises contractors, consultants and building

materials and product producers (DTI 2004; Harvey and Ashworth 1997; Huru 1992; Pearce 2003).

2.2.1 DEFINITION AND CHARACTERISTICS

The definition of the UK construction industry varies according to the focus and scope. These range from those involved in in-situ construction, repair and maintenance of buildings or engineering works to those who manufacture and sell materials, professional services, household repair and constructions works and other non-contracting organisations (Pearce 2003). The industry has both broad and narrow definitions. Major works included in the official definition, which corresponds to the narrow scope of the construction industry include: general construction and demolition; construction and repair of buildings; civil engineering; installation of fixtures and fittings; and building completion such as painting, glazing and plastering (Morton 2002). The gross output of the UK construction industry is shown in Figure 2.1. The figure clearly indicates the contributions of the various components that make up the overall construction output.

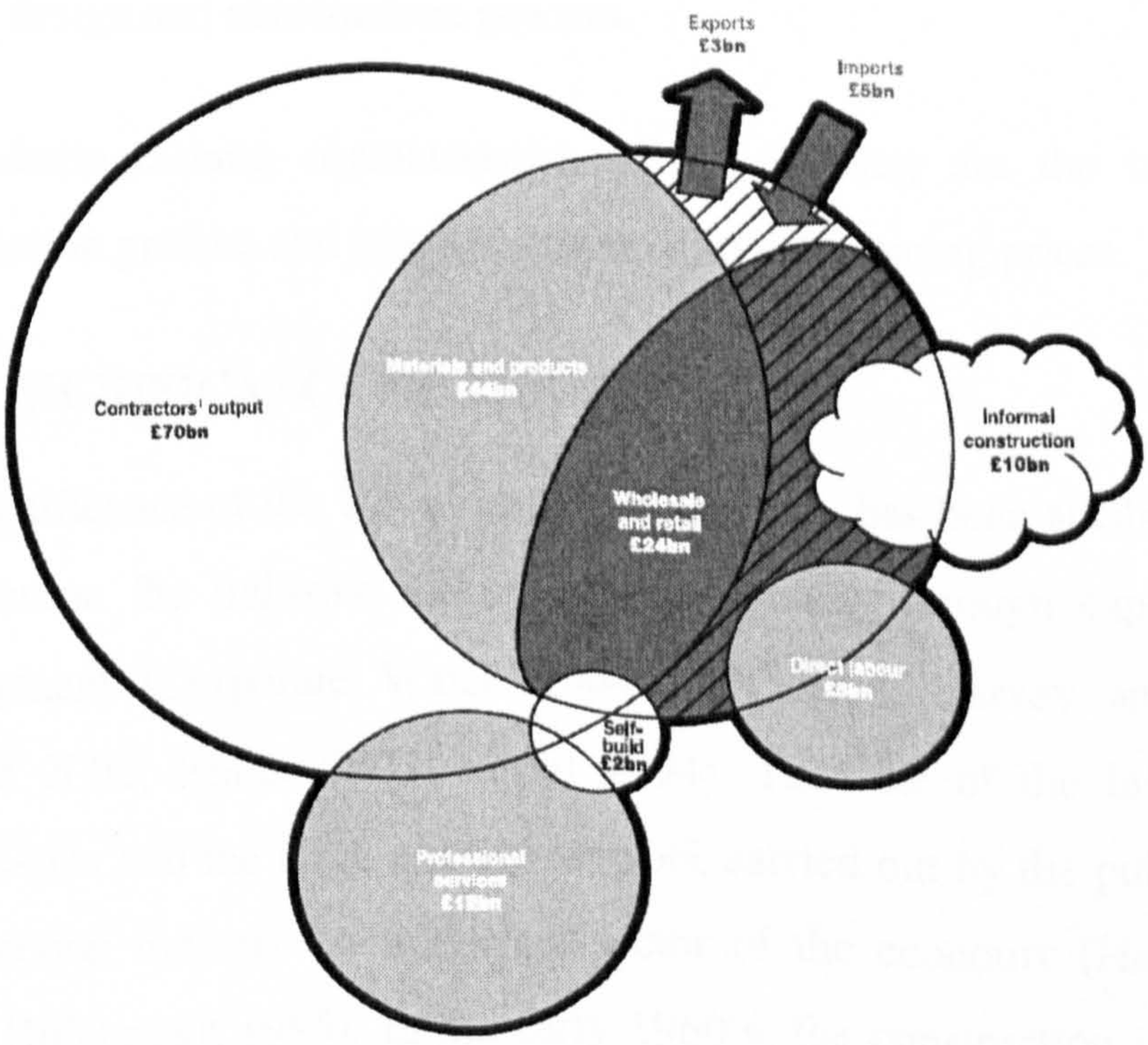

Figure 2.1 Gross output of the UK construction industry

Source: Pearce (2003)

The construction industry is often distinguished from other industry by a number of unique characteristics. Harvey and Ashworth (1997) and Morton (2002) list these as:

1. the physical nature of product is often large covering a large geographical area. The product is also expensive and often represents a client's largest single capital investment;

2. many projects are one-off design to suit the client's need and, therefore, there is the lack of prototypes availability, however, there is limited provision for repetitive and speculative works;

3. the product is either manufactured or assembled on the client's premises in its final location and cannot be transported once completed. A large proportion if often manufactured in-situ and the final product detail can often change from the initial concept; and

4. the design of the product is traditionally separate from construction and different establishments and professional are involved at different stage of the design and construction process.

Other distinguishing characteristics of the industry are the organisation of the construction process and the methods used in determining prices.

2.2.2 SIGNIFICANCE OF THE INDUSTRY

The significance of the UK construction industry has been attributed to the sizeable contribution the industry makes to the economy through capital generation and employment (Corporate Watch 2004; DTI 2004; Harvey and Ashworth 1997; Morton 2002; Pearce 2003; Wyatt 1994). The size of the industry, the level of investments and the large amount of work carried out by the public sector make the construction industry an important sector of the economy (Harvey and Ashworth 1997; Hillebrandt 1985). In the early 1960's, the construction industry was used as an economic regulator by the government although its suitability has been limited in recent years due to increasing involvement of the private sector in partnership with the public sector in project financing (Hillebrandt 1985).

The contribution of the industry to the UK economy has been remarkable, accounting for 7.4% of GDP in 2000 to 10.0% in 2003. Contractors output is estimated in the region of £65 to £70 billion (Corporate Watch 2004; Pearce 2003). The industry is one of the strongest in the world, with an output ranking in the top ten (Crosthwaite and Connaughton 2004). A further 4% rise in total construction output is expected in 2004. The government and its related agencies account for 40% of the industry's output but increasingly, the industry is becoming more reliant on public spending through initiatives such as Private Finance Initiative (PFI) and Private Public Partnerships (PPP) (Corporate Watch 2004; Crosthwaite and Connaughton 2004; DTI 2004).

The industry, which is also credited for building the country, also provides employment for all strata of society (Harvey and Ashworth 1997). The construction industry offers employment to 1.5 million people. Professionals within the industry also have a worldwide reputation and have provided high-tech solutions to environmental, transport and building projects, however, there is an absence of strong overseas competition in the UK domestic construction market (Crosthwaite and Connaughton 2004; Harvey and Ashworth 1997; Huru 1992; Morton 2002).

The continued growth of the construction industry is thus important for the socio-economic development of the UK. Clients and users of the industry's products continuously expect these products to be delivered to the expected standard of time, quality and cost within acceptable safety limits. This expectation has put a lot of pressure on both the products and the producers to continually improve.

The implication for the industry is that the various team would have to work together in order to harness their resources more efficiently and effectively. Consequently, the growth expectation of the industry puts teamwork and subsequent integration of team at the forefront in attempts to be more productive. Continuous improvement is also be more achievable within an effective teamwork environment.

2.2.3 STRUCTURE OF THE INDUSTRY

The construction industry in the UK comprises firms directly involved in the design and construction of buildings, civil engineering and infrastructure works (Harvey and Ashworth 1997; Huru 1992; Morton 2002). The industry is made up of about 170,000 firms but is dominated by small and medium sized firms (SMEs), with less than 250 employees, and a relatively small number of large companies, with over 250 employees (DTI 2004; Morton 2002; Pearce 2003).

The industry undertakes both new, repair and maintenance works. In 2003, new works accounted for 53% of all contractors' output whilst repair and maintenance made up the remaining 47% (DTI 2004). Contractors' output in new works for 2003 was made up of 17% in housing, 7% in infrastructure works, 10% in public non-housing works excluding infrastructure, 4% in private industrial construction and 15% in private commercial construction. Outputs for repair and maintenance for 2003 were 22% for housing and 25% for non-housing works. Details of contractors' outputs, excluding unrecorded estimates of small firms, self employed workers and public sector direct labour departments classified to construction in the 1992 Standard Industrial Classification are in Figure 2.2 below.

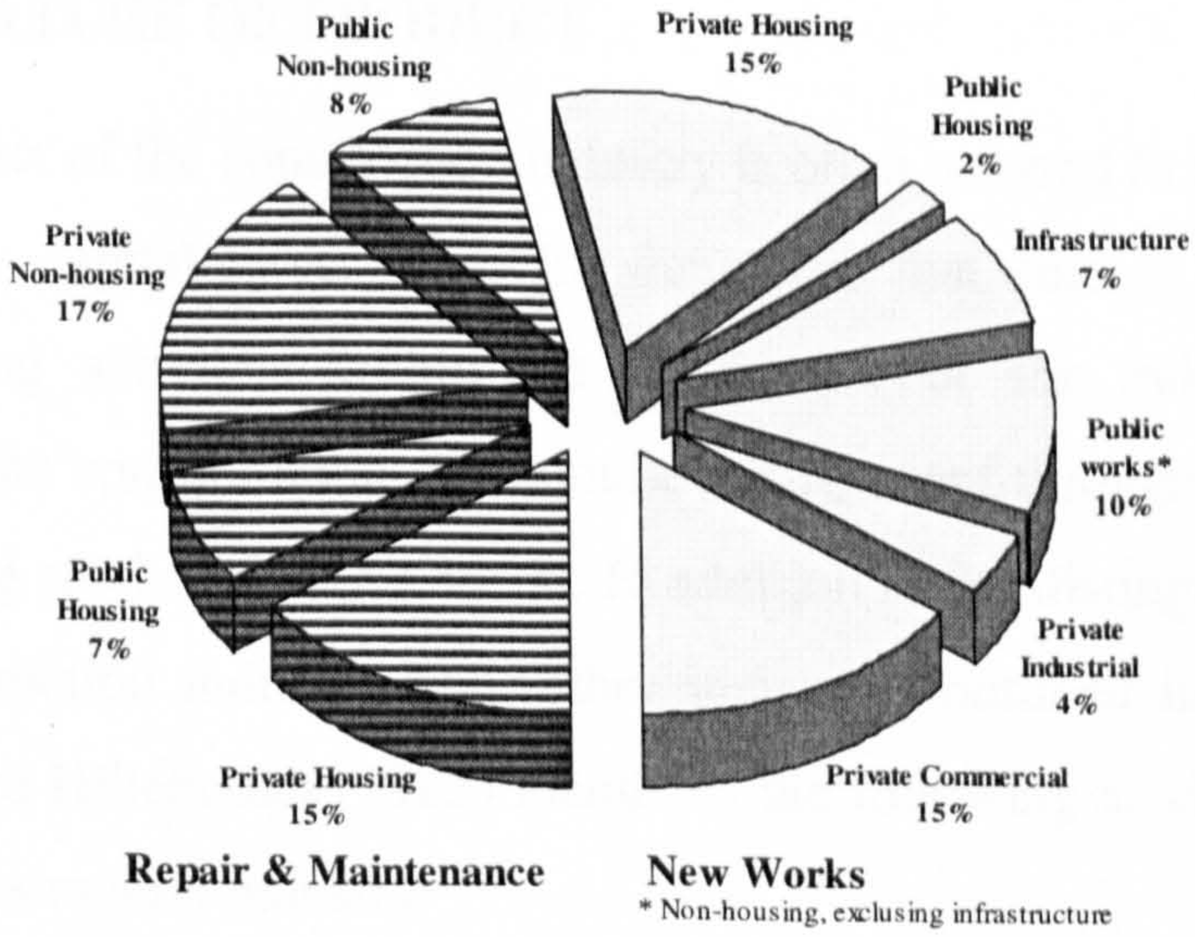

Figure 2.2 UK contractors' output for 2003

Source: DTI (2004)

The major new works sectors within the UK construction industry are as follows (Corporate Watch 2004; DTI 2004; Harvey and Ashworth 1997; Huru 1992).

1. **Housebuilding** - this includes public and private housing and new homes construction. This is the largest single new works sector of the industry, accounting for 32% of contractors' output for 2003 (DTI 2004).

2. **Infrastructure** - road building is the main source of work but there are other sources such as gas, air, communications, water and sewerage and railway. Contractors' output in 2003 for the sector was 7% (DTI 2004).

3. **Industrial construction** - this is the smallest sector of the UK construction industry and includes works such as factories and warehouses. It is mainly private driven and contractors' output for 2003 was 13% of other non-housing works excluding infrastructure (DTI 2004).

4. **Commercial construction** - this sector covers a wide variety of works. It include offices, entertainment, education, health and retail facilities. Output of contractors' in the sector for 2003 was 53% other non-housing works excluding infrastructure (DTI 2004).

2.2.4 NATURE OF PRODUCT

The product of the construction industry is often referred to as a project and has been defined as capital fixed goods for direct use that emerge from building and civil engineering activities within the framework of the industry. Their emergence changed the configuration of the built environment through addition or replacement of existing stocks (Kwakye 1997). In addition to the distinguishing characteristics of the construction industry from other industries outlined in Section 2.2.1, Kwakye (1997) and Hillebrandt (1985) identified the following as characterising the product of the construction industry:

High value – product is very expensive to purchase or build in relation to the income of the purchaser. They are thus paid out of owned or borrowed capital thus making the acquisition of the product a major investment.

Production – the product is assembled or manufactured in-situ at the location where the consumption or utilisation takes place. The production process is affected by adverse weather conditions.

Uniqueness – the product is unique in design, location, price, engineering and production. It is designed to order with emphasis on aesthetic individuality and therefore, mass production techniques cannot be developed and utilised at a reduced cost.

Production cost – the cost of producing a particular product is determined either after negotiation or competitive tendering prior to production. There is reliance on anticipated cost and that makes production a high risk business.

Specificity of order – the product requires a high degree of specificity such as detailed drawing, specifications, and contract details. This is because the product is made to order.

Technological requirement – variation in size and complexity of product calls for different technological input in its production.

Purchase/Sale transaction – the purchase/sale of the product are lengthy and complicated. The transaction often requires legal expertise and estates agents which attract additional expenses.

Diverse interest – there are diverse interest in the product and proof of ownership can sometimes be a difficult, lengthy and costly process.

The many distinguishing characteristics of the product of the industry imply that many professionals and specialist skills are required to produce them. This calls for the use of teams which are able to pull together various complementary skill required to deliver a product or service. This explains why the construction industry has traditionally organised construction activities in teams although the organisation has been pursued along specific professional and trade lines. This has fragmented the industry and has been blamed for the poor project delivery performance. This

research focuses on developing a framework that will improve the integration of all the various professional and functional teams into a single multidisciplinary team. This, however, depends on various arrangements that exist within the industry for the various teams to be involved in a construction project.

2.3 PROJECT DELIVERY

Functional and working relationships within the various teams delivering a construction project are dictated by the contractual arrangement that brings them together. The contractual arrangement is enshrined in the particular procurement approach that is adopted to deliver the project. The organisation, structure and relationships that are contractually allowed or specified within the delivery team on the project are, therefore, dependent on the procurement approach (Huru 1992; Kwakye 1997; Masterman 2002). This section reviews the various procurement approaches that exist in the UK construction industry to highlight how the relationships among the various parties within the project delivery environment have changed over time. It also shows attempts by the industry towards a more integrated working within the project delivery team.

Delivery method is the term used to describe the approach for organising the entire building process, which comprised design and construction. It is the particular combination of professionals and contract arrangements that assign risks and responsibilities in a defined and agreed system (ASCE 2000; Gould 2002; Gould and Joyce 2000; Kwakye 1997). There are four basic strategies or procurement system through which project are delivered (Harris and McCaffer 2003; Masterman 2002; Rowlinson 2004; Tookey *et al.* 2001). These are:

1. **Separated (design led);**
2. **Integrated (producer led);**
3. **Management-oriented (project co-ordinator led); and**
4. **Discretionary (a combination).**

The client (or the client's representative) usually decides through this method which experts and firms need to be engaged, when to employ them and the type of contract under which the project is to be procured. The delivery systems categorisation is based on (Masterman 2002):

1. the amount of risk taken by each participating party;

2. the level of information required at the time the construction contract is let;

3. contractor reimbursement approach; and

4. management of interaction between design and construction and sometimes funding and operation.

Contractual and functional relationships among the parties are clearly defined within each procurement system. There are also advantages and disadvantages that each system brings to the various parties within the building process (Huru 1992; Tenah 2001).

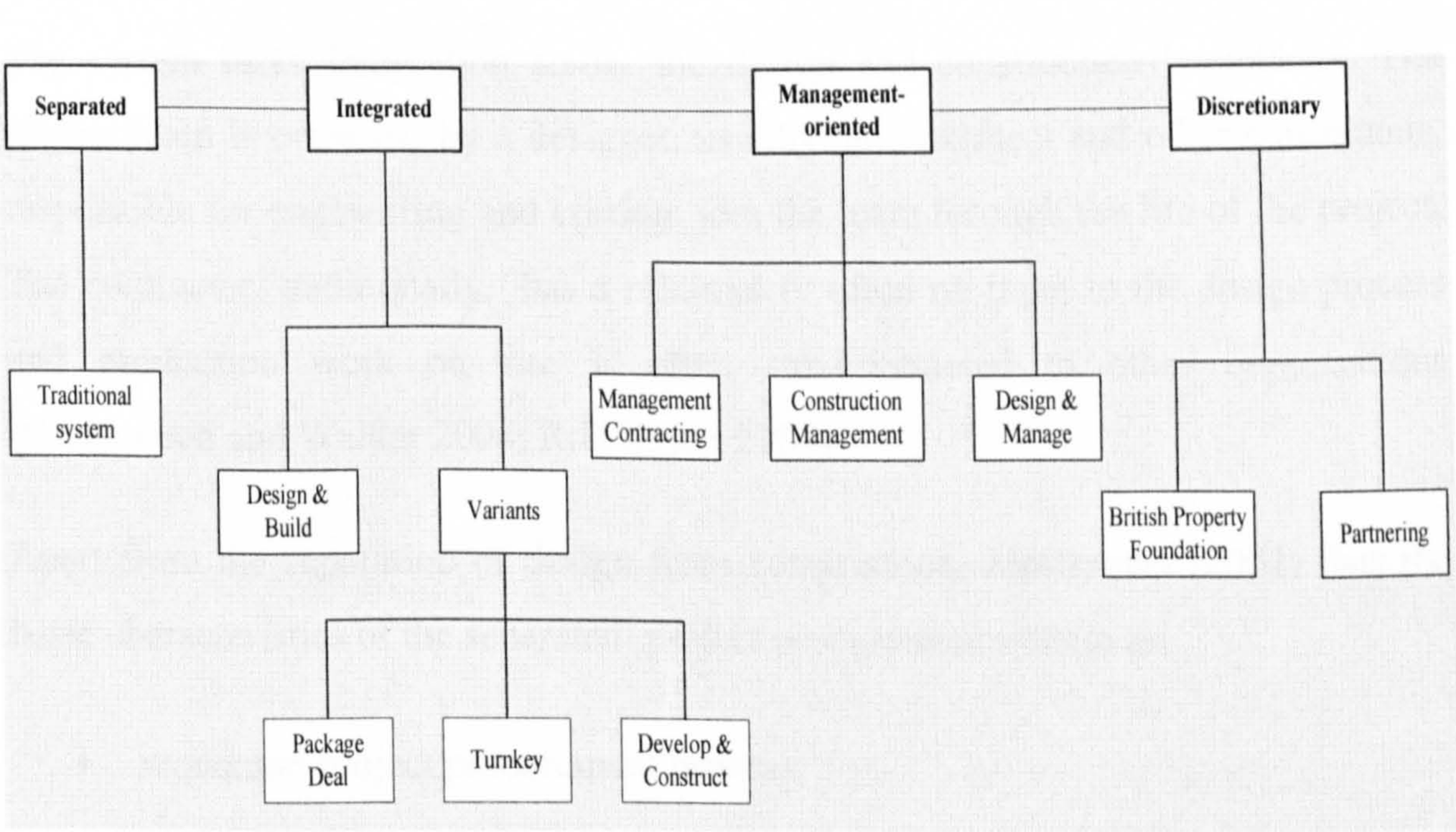

Figure 2.3 Categorisation of project procurement systems

Sources: Harris and McCaffer (2003) and Masterman (2002)

2.3.1 SEPARATED PROCUREMENT

The separated procurement system is often referred to as the "traditional or conventional method", where the design is totally separated from construction. The unique characteristic of this system is the separation of responsibility for the project design from its construction. Consultants are appointed for design and cost control and the contractor is only responsible for the construction work (Gould 2002; Huru 1992; Masterman 2002).

The main parties in the system are the:

1. **Client** – the owner of the project;

2. **Consultants** – responsible for design (architectural, structural and services) and cost control; and

3. **Contractor** – responsible for construction work and management of both nominated and domestic sub-contractors.

The system lacks integration across the design and construction boundaries. The project team is often led by a designer, usually, an Architect and other consultants, responsible for engineering and costing, join the team through the life of the project. The contractor, traditionally, has a minimal or often no input to the design process and production work on site is often sub-contracted to other organisations (Greenwood and Walker 2004; Rowlinson 2004).

Apart from the separation of design from construction, Masterman (2002) lists the basic characteristics of the separated project procurement system as;

- sequential project procurement process;

- design completion or near completion before the commencement of construction works on site;

- division of responsibility for managing the project between the client's consultants and the contractor leaving very little for the involvement of either party in each other's activities; and

- fee and expense basis reimbursement for the consultants and measurement or lump sum payment for work done by the contractor.

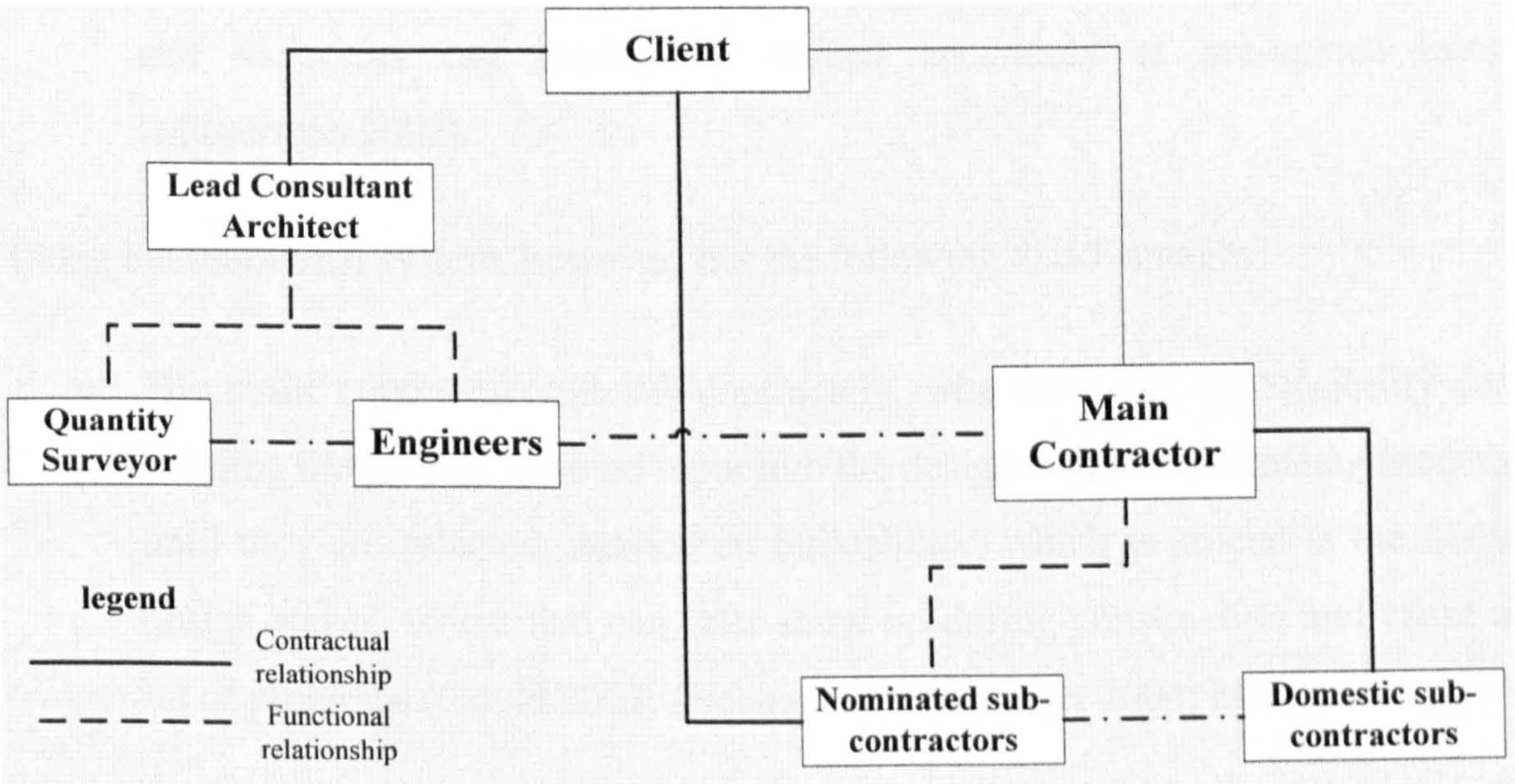

Figure 2.4 Relationships between parties in traditional procurement system

Sources: Huru (1992) and Masterman (2002)

The traditional procurement system has the following advantages.

- It allows sufficient time and freedom for designs to be fully developed in consultation with the clients. There is, therefore, a higher degree of certainty in achieving the quality and functional standards (Masterman 2002; Morton 2002).

- The system is familiar to most clients, designers, and contractors. It is well established and easy to understand and control systems, documentation and organisations are all set up to manage the process effectively (Gould 2002; Huru 1992).

- The system leads to competitive pricing from open market because the client is able to advertise with a completed set of contract documents. Tendering cost is also low to the contractor and the client has a better indication of the final project cost because of the availability of fully developed designs and agreed prices (Gould 2002; Masterman 2002; Morton 2002).

- The availability of bill of quantities makes interim valuations easy to assess and variations can readily be valued accurately at pre-agreed rates (Masterman 2002).

Using the traditional system, however, has the following disadvantages:

- The main contractor and sub-contractors, who have the responsibility for building the project, have no input into the design or initial estimating process until they are selected. Advice on buildability, which is crucial at the early design stages, is lost and can later show up during construction and cause a lot of problems (Gould 2002; Greenwood and Walker 2004; Morton 2002).

- The sequential, fragmented and confrontational nature of the system can result in a long time delay between initial proposal and commencement of work on site. This leads to increased cost in fees and material price increases (Bower 2003; Huru 1992; Masterman 2002; Morton 2002).

- There is little opportunity for interaction and team building between the participants. Interpretations are made independently and that lead to conflicts of objectives and adversarial relationships (Gould 2002; Greenwood and Walker 2004; Morton 2002).

- Changes to scope and design errors and omissions are expensive and have been the main causes of delays and increased costs. There is, therefore, a permissive attitude to changes that are necessary for better performance of the project or facility (Gould 2002; Masterman 2002).

The traditional system enables the client to know the cost of the project before construction works start, however, collaboration for buildability is sacrificed at the design stage of the project. Consultants are reluctant to make design changes but when they do, it comes at a very high cost to the client. The long delay between concepts and realisation makes it unsuitable for fast tract project. The traditional system is more favourable where speed is not a priority, budget is tight and high design certainty is required.

2.3.2 INTEGRATED PROCUREMENT

Integrated procurement system incorporates both the design and construction of a project in a single package (Masterman 2002; Miller and Evje 1999; Stillman 2002; Tenah 2001). The system is producer led and the term "package deal" has been used for many years within the construction industry to cover design and build, the "all-in" service, develop and construct and turnkey. The most distinguishing characteristic of this system is the single point responsibility taken up by the contractor for design and construction (Gould 2002; Masterman 2002; Stillman 2002; Tookey *et al.* 2001). The approach also allows the overlapping of design and construction phases (Rowlinson 2004).

2.3.2.1 Traditional Integrated or Design and Build

Design and Build is the main category under the integrated procurement systems but other variants exist (Masterman 2002; Miller and Evje 1999; Stillman 2002; Tenah 2000). The discussion of integrated delivery system will, therefore, be based on Design and Build. The various forms of Design and Duild are Novated Design and Build, Package deal, Turnkey and Develop and Construct (Akintoye 1994; Greenwood and Walker 2004; Masterman 2002). These are defined and discussed later in this section of the thesis. The discussion focuses on the key principles of the arrangement and highlights the advantages and disadvantages of each variant to reinforce their unique identity.

The main parties involved in the system are:

1. Client – the owner of the project; and

2. Contractor – responsible for the design (in-house or consultant retained by contractor) and construction of the project.

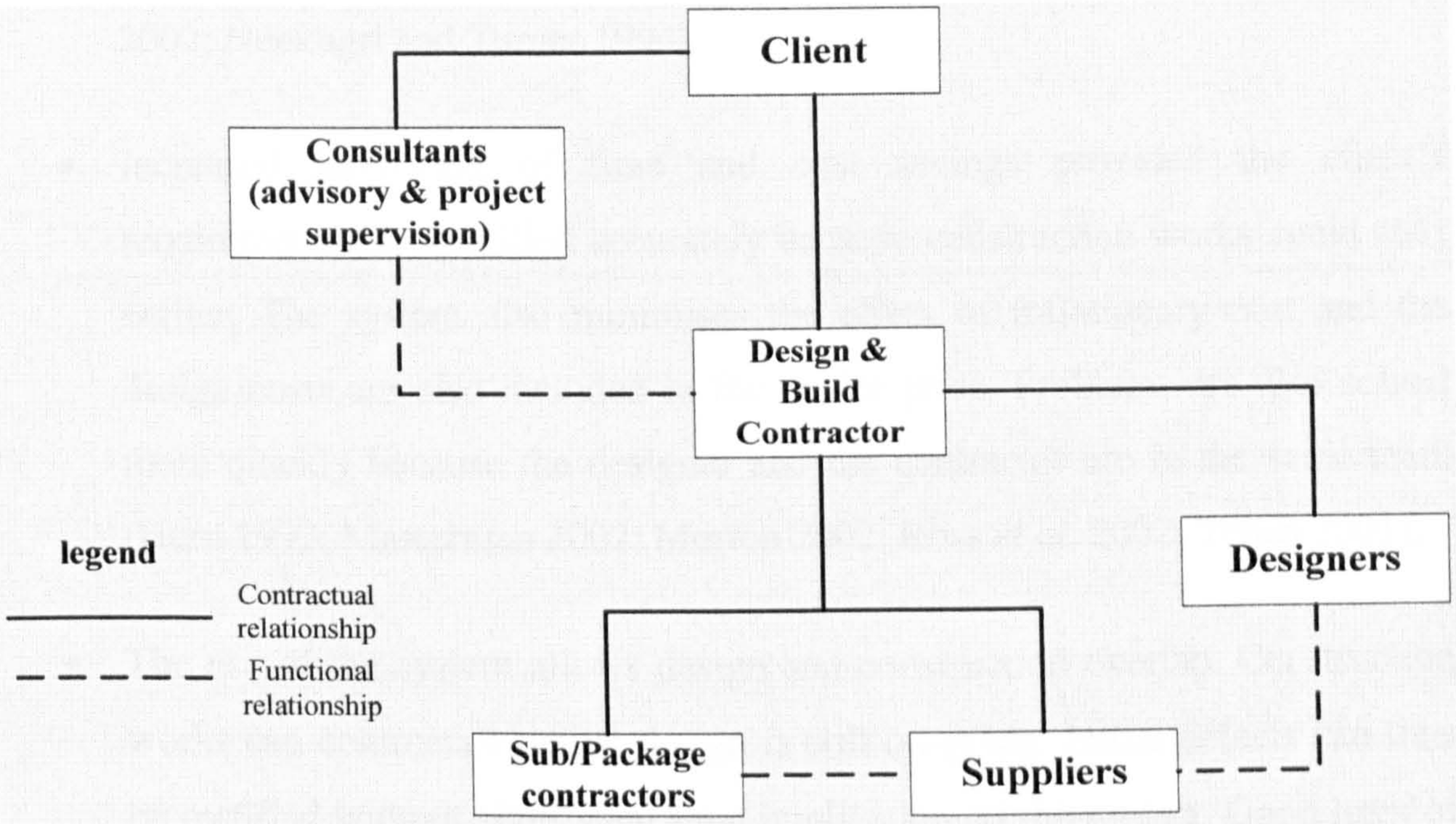

Figure 2.5 Relationships between parties in integrated procurement system

Sources: Huru (1992), James and Walker (2002) and Masterman (2002)

The system is characterised as an integrated team approach, which allows the design and build contractor to take a key central role in the design process, a shortcoming of the traditional system (Knight et al. 2002). The system focuses on a reduced number of contractual relationships as the client deals with a single firm which provides both the design and construction of the project. This method could be argued as the oldest delivery system in the UK and has also enjoyed an increase in popularity within the past 10 to 15 years (Akintoye 1994; Masterman 2002; Ndekugri and Turner 1994; Ross et al. 2002).

The traditional integrated or design and build procurement system is credited with the following advantages highlighted below:

- The client has to deal with a single contract, with the design and build contractor who is responsible for all aspects of the project. This option reduces disputes over delay or incomplete design documents since the contractor is responsible for the flow of design information. The complexity and complications in dealing with a number of separate organisations are also avoided (Huru 1992; Jaggar and Morton 2003; Masterman 2002; Morton 2002; Ndekugri and Turner 1994).

- Increased likelihood of time and cost savings provided the client's requirements are specified accurately because construction works could start earlier. The system also minimises the effect of inflationary cost and the design costs are also included in the tender price. Problems are also solved more quickly because the designer and the contractor are in the same team (Huru 1992; Masterman 2002; Morton 2002; Ross *et al.* 2002; Tenah 2001).

- The use of the system allows design and construction overlap. Construction works can commence whilst design is still on-going. Initial defects can thus be rectified without significant time implication on the project. Good lines of communication between the client and the contractor are established leading to an improvement in the overall management and buildability of the project (Ashworth and Hogg 2002; Masterman 2002; Morton 2002; Ross *et al.* 2002; Stutz 2000).

Disadvantages associated with the integrated or design and build procurement system include the following.

- Difficulty in evaluating proposals and tender submission, especially where there are ambiguities or lack of precision or inaccuracies in the client's brief. There is no client representation on the design-construction team and the control over design and construction integration is given over to the contractor (Ashworth and Hogg 2002; Jaggar and Morton 2003; Masterman 2002; Murdock and Hughes 2000; Tenah 2001).

- Design errors are likely to be covered up by the contractor and the final product may differ from the expectation of the client due to minimal client involvement. Quality can also suffer in where a guaranteed maximum price or lump-sum has been quoted for the project. It is a rigid system and does not allow the client to develop the brief further (Ashworth and Hogg 2002; Cooke 2004; Tenah 2001).

- There is reduced cost management and client makes full commitment prior to design completion. Changes from the client become more expensive and therefore prohibitive although sometimes unavoidable. Project can eventually become price driven at the expense of quality (Ashworth and Hogg 2002; Cooke 2004; Murdock and Hughes 2000).

Integrated procurement systems are particularly suitable for fast track delivery of projects. They enable construction work to commence before the final completion of design. Project buildability, design information flow and commutation are enhanced because the design and construction teams work together. The design is significantly integrated with construction, however, the growth of the system has created considerable controversies as remarked by Morton (2002), the main reason being the reduced power of the design team, especially the architect. The problem of quality has also being realised by clients. These difficulties and deficiencies have led to the development of other variants of the integrated or design and build project delivery system discussed in Section 2.3.2.2.

2.3.2.2 Novated Design and Build

In Novated Design and Build arrangement, the client produces the conceptual design, and prepares the Design and Build tender documentation for the project. A design team is novated to the successful bidding contractor for the detailed design of the project. The client has more influence and control to shape the outcome of the project. The design team usually acts as consultants to the contractor (Masterman 2002; Murdock and Hughes 2000; Parry *et al.* 2003; Ross *et al.* 2002; Walker 2003).

The retention of the design team throughout the construction process ensures a consistent design standard. The knowledge of the design team through their early involvement on the project helps prevent potential future design difficulties. However, working relationships between the novated design team and the design and build contractor can sometimes suffer due to the "imposition" of the design team by the client. Additional costs may also be incurred by the client in appointing a supervising team to monitor the design of the project (Masterman 2002; Parry *et al.* 2003; Ross *et al.* 2002).

Package deal

A Package deal arrangement provides a finished building product, total package, which meets the requirement of the client. The client effectively chooses a building from the manufacturer's catalogue. There is little or no design input from the client and all responsibility for the project is given to the package deal contractor. An in-house design team is usually used by the contractor. The client can, however, retain an independent adviser during the construction period (Ashworth 2002; Chapell et al. 2001; Jones and Saad 2003; Masterman 2002). The client, through the availability of a "product catalogue", is able to assess the practical and aesthetic appeal of the project. The client also benefits from the tried and tested product but the use of proprietary system may not meet all the client's requirements and are known to have shown serious structural failures from poor design and detailing (ASCE 2000; Ashworth 2002; Masterman 2002; O'Reilly 1999).

Turnkey

Turnkey procurement system provides a single point responsibility for the design, construction and finance of a project. It includes everything from inception to completion and the turnkey contractor is paid upon completion and commissioning of the project. The client takes over the facility provided and is able to commence immediate use. The turnkey contractor is not required and has no additional responsibility for operating the facility (ASCE 2000; Ashworth 2002; Masterman 2002; O'Reilly 1999; Smith 1999). The cost to the client in the use of this arrangement is higher than conventional methods of project delivery but the facility

is available for use immediately after taking possession (Lewis 2000; Masterman 2002; O'Reilly 1999).

Develop and Construct

Develop and Construction arrangement allows for the preparation of conceptual design from detailed briefing by the clients consultants. The conceptual designs are then passed on to a contractor to produce detailed design and select specified materials for bid proposal submission. The client is able to determine the detailed concept of the project before competition for detailed design and construction of the project (Akintoye 1994; Lewis 2000; Masterman 2002; O'Reilly 1999). The client is able to use in-house design expertise to influence the shape of the final project. Design and build bid evaluations are made easy by the involvement of the in-house design team. Responsibility for the design of the project can be disputed as both the client and the contractor design team have an input into design (Masterman 2002; O'Reilly 1999).

2.3.3 MANAGEMENT-ORIENTED PROCUREMENT

Management-oriented procurement systems enable a management contractor to join the design team at the earliest possible time prior to construction. The contractor is employed on equal terms to the consultants (design and cost) on the project (Harris and McCaffer 2003; Masterman 2002). The management contractor is responsible for preparing the overall construction programme and works packages and steering them through the design stage. Package or sub-contractors are recommended and/or appointed by the management contractor, thus enabling their efficient integration (Harris and McCaffer 2003).

The management-oriented procurement system has the following main parties:

1. **Client** – the owner of the project;

2. **Design team (Consultants) -** responsible for the initial design and final design supervision or initial and final design of the project;

3. **Contractor** - responsible for managing the construction, works contractors and sub-contractors and advising the design team; and

4. **Sub-contractors** – responsible for carrying out actual construction works.

Design and construction supervision are undertaken separately by the appointed professional team. Designers and sub-contractors are required to provide detailed programme to ensure effective co-ordination and cooperation. Implementation functions are thus better performed and the dismantling of the project into sub-projects that can be better executed by sub-contractors lead to cost and time savings. The use of the system leads to improvements in integration and management of multiple contractor construction (Harris and McCaffer 2003; Harrison and Lock 2004; Kovacs 2004; Masterman 2002).

Harris and McCaffer (2003), Greenwood and Walker (2004) and Masterman (2002) list the following as the main advantages of the system.

- Project commencement is accelerated and this consequently, leads to early completion when compared with other delivery systems such as where the design is separated completely from construction.

- The design team benefits from the expert advise of the contractor or manager on design, buildability, programming and availability of materials. The general construction expertise of the contractor is also made available to the designers.

- There is a high degree of flexibility for delays and changed in design and rescheduling of work packages. The fragmented financial structure of the system also limits the effect of any monetary failure of any works contractor to the overall project.

- Competition is achieved through the use of works packages and project cost can be adjusted for uncommitted sections of the project should the already awarded part exceed the projected cost.

Disadvantages of the system include the following.

- The Contractor's liabilities are limited to the management of the works and the client carries the majority of the project risks. Consequently, recovery from failure of works-package contractors that affect other sections of the work can be a very difficult task.

- The cost of remedying defects from poor quality works from any sub-contractor unwilling or unable to rectify defect is passed on to the client as the contractor's responsibility is limited to supervisory and management roles.

- The client can incur additional cost in appointing additional site supervision to ensure that high quality standards are maintained and defect responsibilities are readily identified.

- A firm tender price is usually not available to the client before the start of the project although the system ensures that there is keen competition for almost all sections of the project.

There are three main variants of the management-oriented delivery systems. These are:

1. **Management Contracting;**

2. **Construction Management; and.**

3. **Design and Manage.**

These delivery systems exhibit the common characteristics of equal contractor-consultant status. The key emphasis, however, is on the integration of the management of both design and construction (Greenwood and Walker 2004; Harris and McCaffer 2003; Kovacs 2004; Masterman 2002; Murdock and Hughes 2000). The use of management-oriented delivery system has been on the increase in the past three decades in the UK commercial construction sector where projects are usually

large and complex. This is because of the sector's demands for early start and completion, more control over project cost and higher standards for functionality and quality (Masterman 2002; Murdock and Hughes 2000).

2.3.3.1 Management Contracting

Management Contracting involves the appointment of a construction based organisation as a professional team at the initial stages of a project to provide construction expertise to the design and manage the construction works. The management contractor is employed solely for managing the works thus the delivery method relies completely on sub-contracting. The package or works contractors are employed by the management contractor who is reimbursed for actual prime cost of construction and a fee for management services (Howes and Tah 2003; Masterman 2002; Murdock and Hughes 2000).

The procurement system allows much flexibility for the client as detailed design can proceed in parallel with the first stages of work. The experience of the contractor is made available to the project team at an early stage. It is suited to large scale complex project where early completion is the main goal as the system leads to reduced risk of delay, making time overruns highly unlikely (Huru 1992).

The client can obtain a guaranteed maximum price for the construction element of the project but a possibility of conflict of loyalty on the management contractor's status as an adviser to the client can also occur. The responsibilities of the management contractor can sometimes be unclear as contracts are with the works contractors but payment is by the client. Quality control can also become problematic as the management contractor is not responsible for construction but only the management of the works (Huru 1992; Kovacs 2004; Masterman 2002).

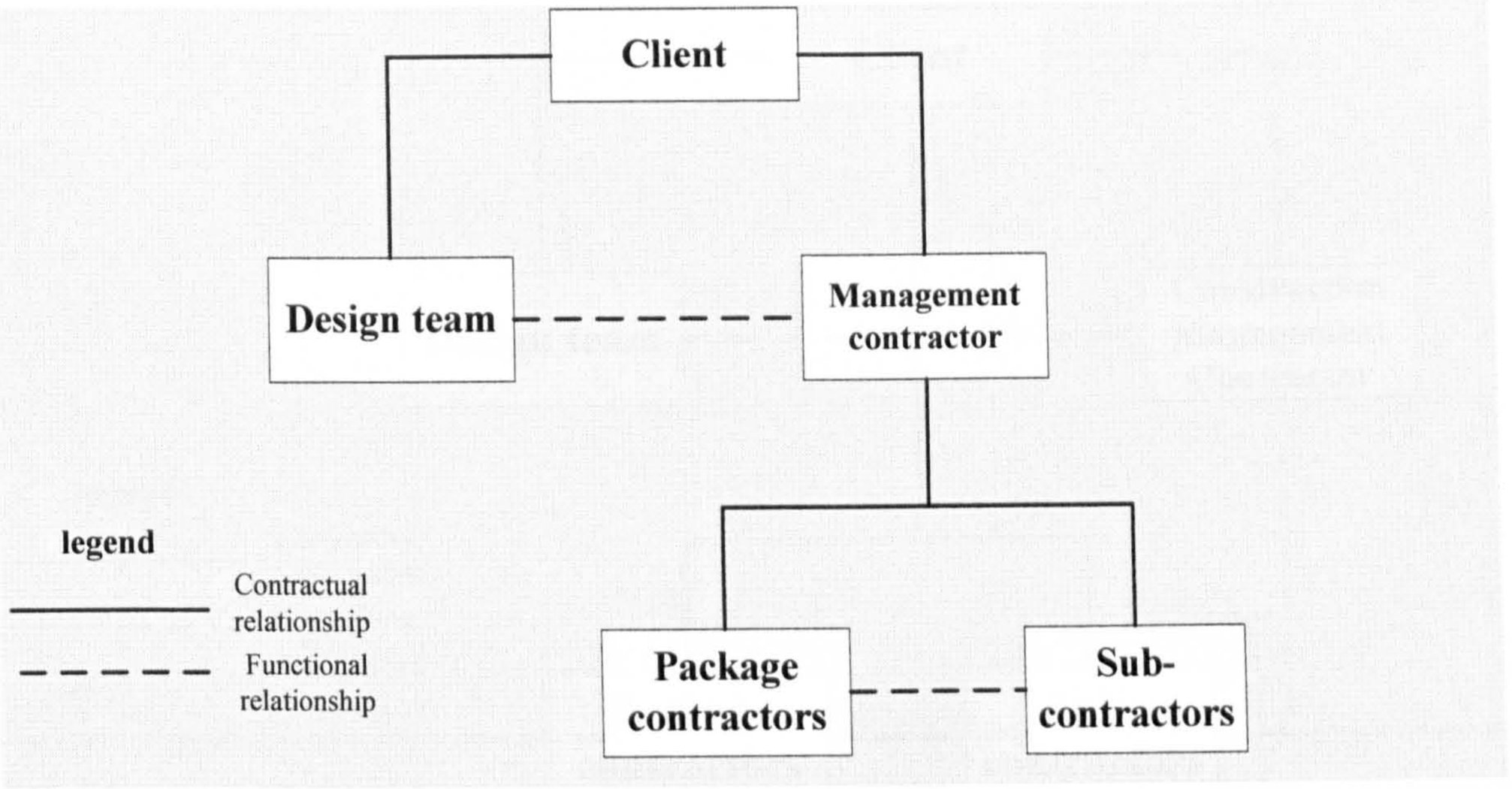

Figure 2.6 Relationships between parties in Management Contracting procurement system.

Sources: Huru (1992) and Masterman (2002)

2.3.3.2 Construction Management

Project delivery through a Construction Management procurement system involves the appointment of a construction management contractor early in the project to provide a planning, management and co-ordinating function. The physical construction works are let by sub-contracting packages to contractors who are directly employed by the client. The construction management contractor is reimbursed by the client for overall management and supervision of the construction works, advising the design team on buildability and drawing up suitable work package contracts (Cooke 2004; Harris and McCaffer 2003; Harrison and Lock 2004; Kovacs 2004; Masterman 2002).

Construction management can result in a more constructive and positive attitude at management, supervisory and operative levels of the project if applied correctly. Confrontation between the design and construction supervision team is reduced and the client's increased involvement in the management of the project also improves working relationships within the project team. There is increased competition for construction works on large projects due to work packaging and splitting into smaller and more manageable sections (Kovacs 2004; Masterman 2002; Walker 2003).

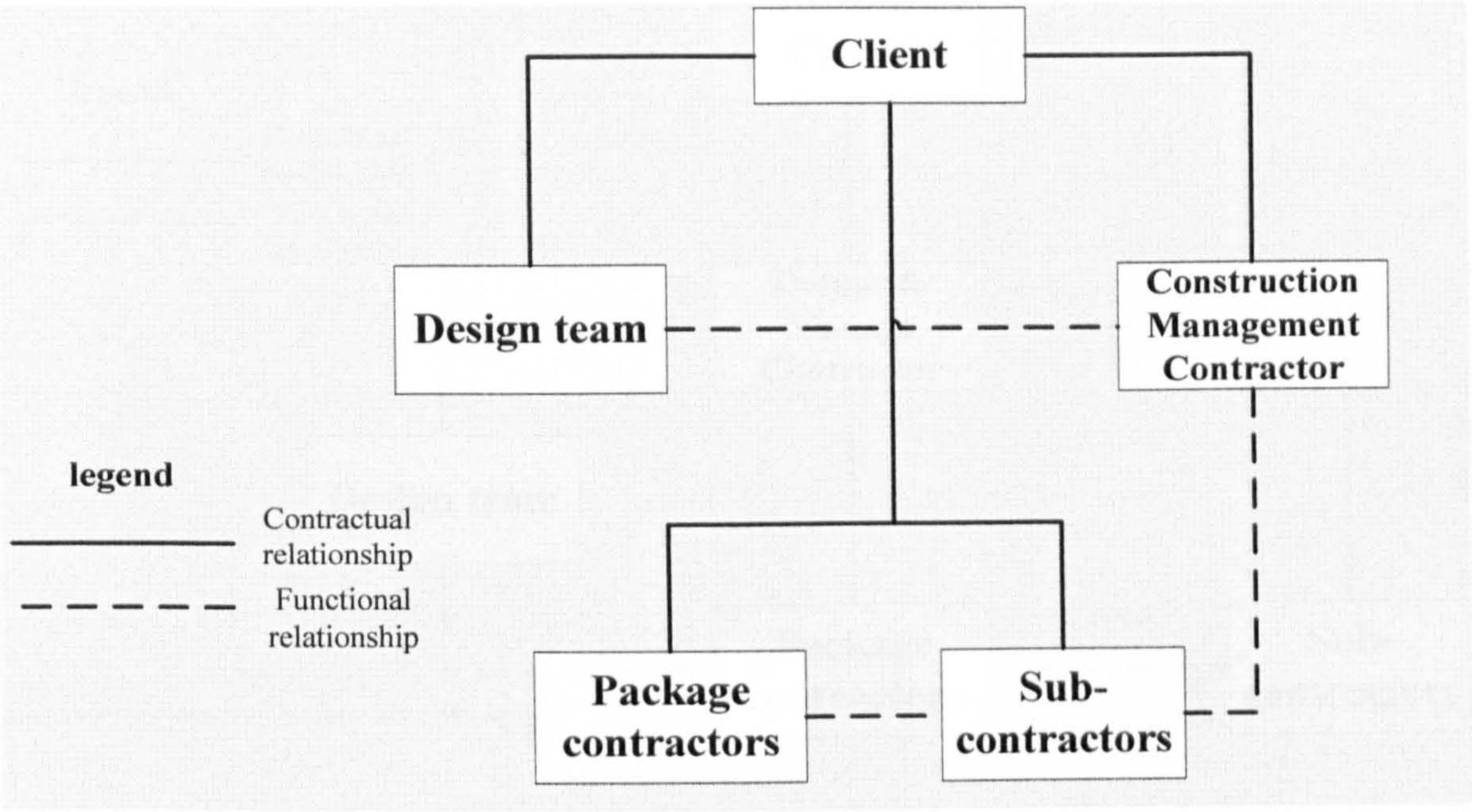

Figure 2.7 Relationships between parties in Construction Management procurement system.

Sources: Huru (1992) and Masterman (2002)

The system requires extensive client involvement at all stages of the project. Additional administrative responsibilities and co-ordination of activities of the construction management contractor and the design team are passed on to the client and this arrangement can, sometimes, be complex and costly to the client. A common position on the reimbursement of fees can be ambiguous as the responsibilities of the construction manager vary from project to project. The division of payment into percentage fee and lump sum for services provided can negatively impact the construction management contractor's position as the client's consultant and lead to a conflict of loyalties (Gould 2002; Masterman 2002).

2.3.3.3 Design and Manage

In Design and Manage procurement, a single organisation is appointed by the client to both design the project and manage the construction using package contractors to carry out the actual construction works. The Design and Manage contractor is paid a fee to manage and assume responsibility, not only for the works, but also for the design team. Design and manage is particularly suited to projects with high reliance on specialist sub-contractors who undertake their own design (Kovacs 2004; Masterman 2002; Morledge 2002).

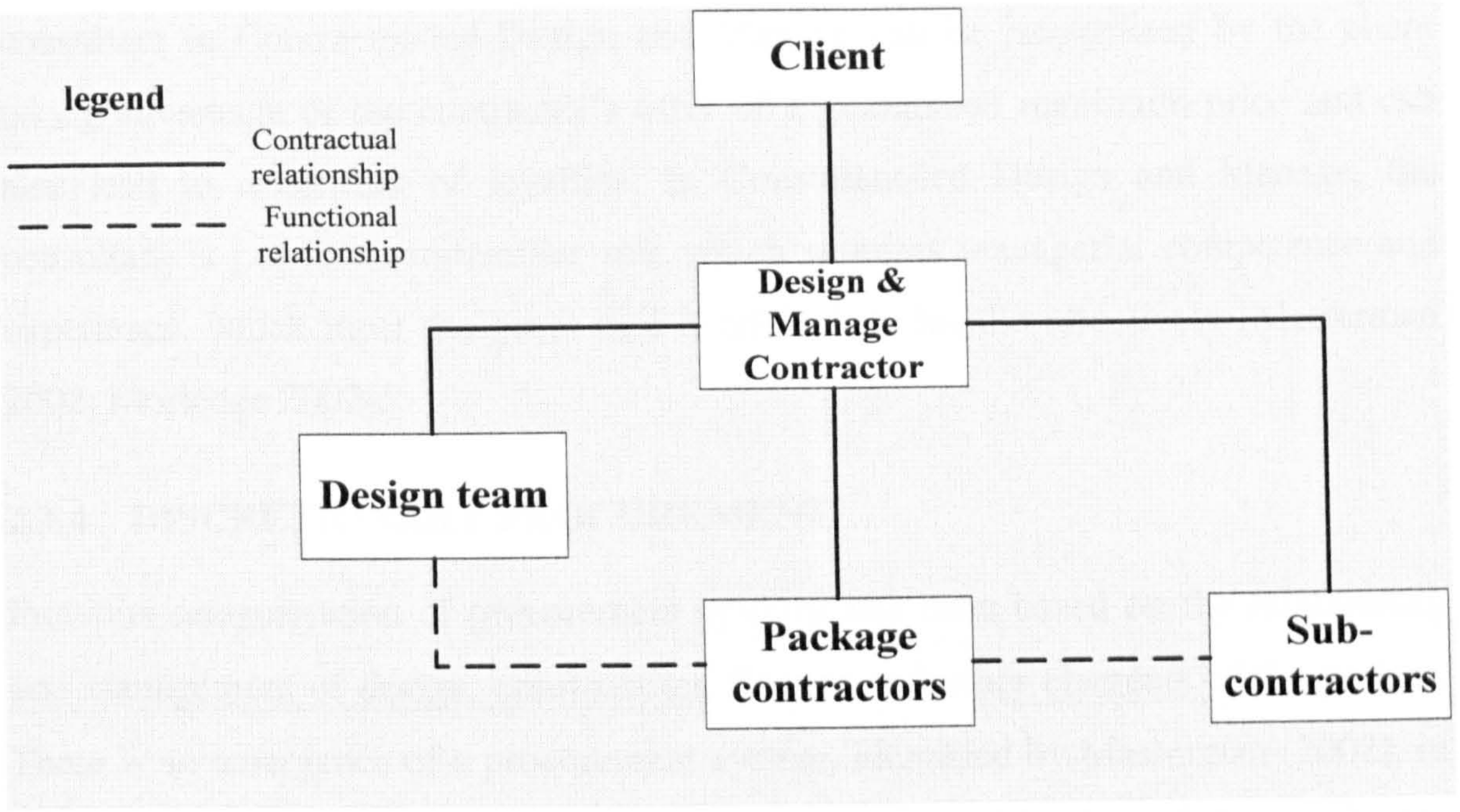

Figure 2.8 Relationships between parties in Contractor-led Design and Manage procurement system

Sources: Huru (1992) and Masterman (2002)

The system has two variants, contractor-led and consultant-led. In the contractor-led variant, the works packages are direct contracts design and manage contractor and the package contractors. Direct works package contracts are formed between the client and the package contractors in the Consultant-led Design and Manage (Kovacs 2004; Masterman 2002).

Design and Manage can lead to early completion because the design and construction are better integrated and overlapped. There is improved communication and better understanding of design due to the on-site presence of the project designers. In contractor-led design and manage, the client can obtain a guaranteed maximum price for the construction element of the project and a fixed lump sum for the design and management of the project. A fee structure incorporating cost penalties and incentives can also be agreed with the client in consultant-led design and manage delivery system (Masterman 2002; Morledge 2002).

The presence of the design team on site can prove costly and time-consuming unless there is above commitment from the design manager. Price certainty is only achieved when all the works packages have been let. The contractor's status as the client's

consultant in Contractor-led Design and Manage can be jeopardised by the client taking advantage of the contractor's offer of a guaranteed maximum price and can also lead to a conflict of loyalties. In Consultant-led Design and Manage, the consultant is put in an unfamiliar role which requires managerial competence and experience, which most designers find it difficult to handle effectively (Masterman 2002; Morledge 2002).

2.3.4 DISCRETIONARY PROCUREMENT

Previous categorisation of procurement systems has been based on the relationship and management of design, construction, finance and other elements of the project. There is an emergence of a procurement system, identified by Masterman (2002), in which the client has the discretion to use one or a combination of the previously known procurement system within a specific setting under his/her control. An administrative and cultural framework which allows the imposition of specific management style or company culture and also allow the use of the most suitable of all procurement methods by the client can be termed as a discretionary procurement system. The British Property Federation system and Partnering can be both described as discretionary procurement system.

2.3.4.1 British Property Federation (BPF) System

The BPF system was first introduced in 1983 for building design and construction. This method of procurement differs from others and changes the traditional roles of the parties to the process. The method is suited to client organisations that have no construction expertise (Huru 1992). Examination of the BPF manual indicate that the method leads to the production of good buildings in more quickly and at a lower cost (Masterman 2002). It is also flexible and, therefore, does not try to prescribe any exact organizational structure. Each stage is definitely punctuated by a client decision about whether or not to proceed with the project (Hughes 1991).

Huru (1992) indicates that the BPF procurement system divides a project into five stages; concept; design brief; design development; tender documentation; and contractor's design and construction. A summary has been presented in Table 2.2.

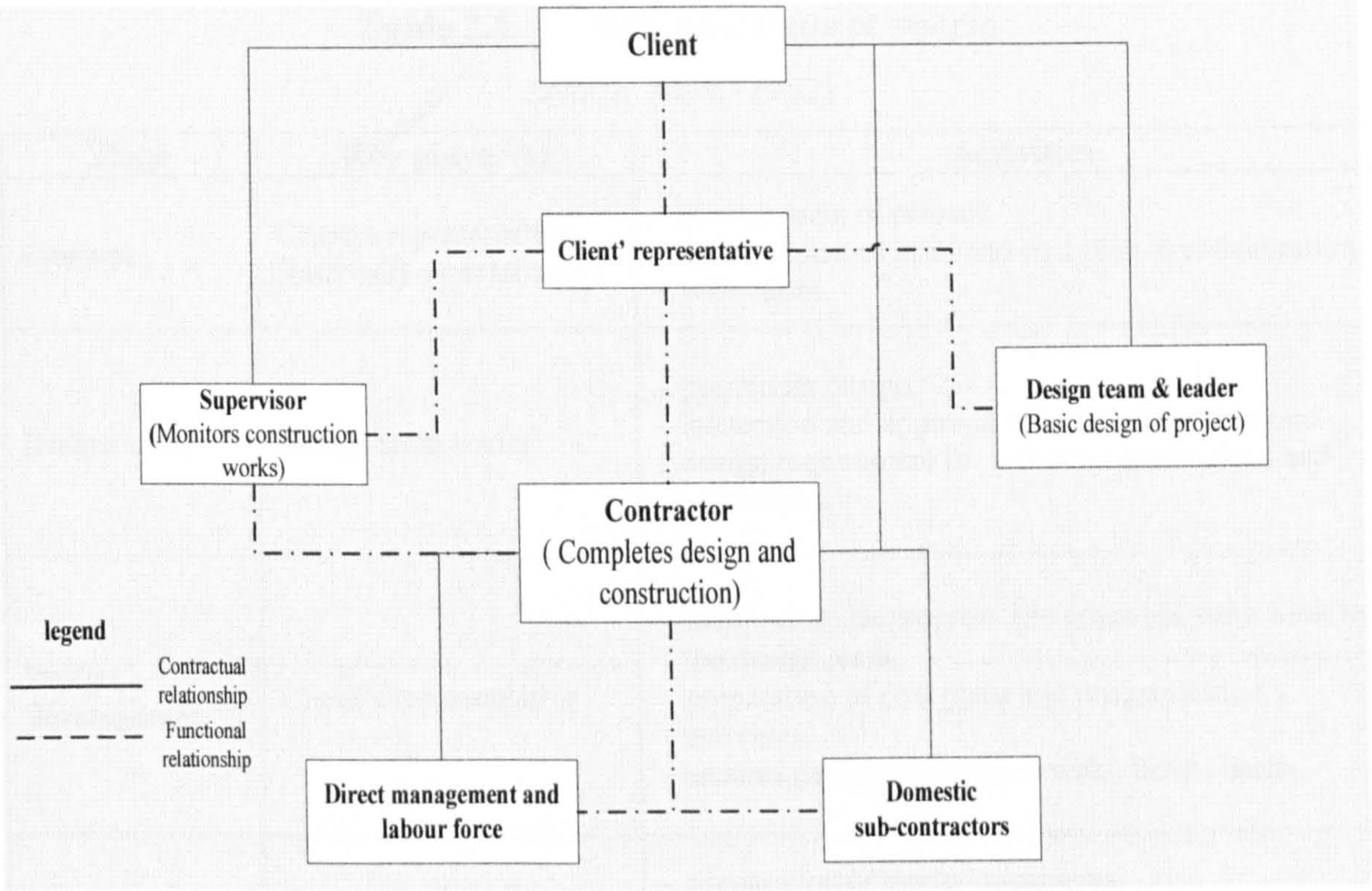

Figure 2.9 Relationships between parties in the BPF procurement system

Sources: Masterman (2002) and Huru (1992)

The BPF can be preferred because it allows for the thorough evaluation of risk to all parties involved in the project and gives them an opportunity to affect cost and contribute to the smooth progress of the project. The contractor's expertise may be used because of his involvement in the final stages of design that leads to better construction techniques (Huru 1992).

The procurement system, however, allows greater client involvement, especially, in sub-contractor selection which can create conflicts with the main contractor. It also comprises multiple sub-processes which in itself can be very complicated and make relationships within the project unclear to many. It depended somewhat of confrontational approach to the management of project (Huru 1992; Masterman 2002). The key features of the BPF procurement system are summarised in Table 2.1.

Table 2.1 BPF procurement system

Source: Huru (1992)

Stage	Key player(s)	Activities
Concept	Client's representative (Internally or externally)	- management of project. - development of brief and cost plan in collaboration with client.
Design brief	Design team leader	- pre-tender design. - inspection and approval of contractor's designs. - design requirement for statutory applications and permission.
Design development	Client's representative	- monitoring the progress and approves work done by the design team. - preparation of cost plans and programme of activities. - ensures design compliance with client's needs.
Tender documentation	Representative and Design team leader	- preparation of tender documents. - Approval of design documents. - competitive tendering.
Contractor's design and construction	Contractor, design team leader and Client's representative, construction supervisor.	- development of design into working drawings. - approval of contractors designs. - invoice approval, modification decision and instructions. - monitoring of construction.

2.3.4.2 Partnering

Partnering had been used in the construction industry in the UK to describe a wide range of innovative approaches to the management of contractual relationship. The Construction Best Practice (2003) defines partnering as a structured management approach to facilitate teamworking across cultural boundaries. The definition further identifies components of the approach as formalised mutual objectives, agreed problem resolution methods and active search for continuous measurable improvements. The definition identifies three core fundamental elements of the approach which are summarised by Masterman (2002), as:

- the attainment of collective mutual project objectives through improved performance by all parties;

- initial agreement of method of problem resolution; and

- measurable continuous performance of the project team.

Partnering is not a soft option but Pheasey (2003) remarks that, considerable benefits of shared savings, improved cost predictability and shared resources, can be achieved with committed participants in an appropriate circumstances. He, therefore, called for good working relationships to be established prior to comencing work. Communication, strong leadership and organisational acceptance of partnering are also essential. He concluded that Partnering can become easier with practice.

Masterman (2002) highlights the advantages of partnering as:

- reduced project cost and construction periods, especially when used strategically over a number of projects;

- improved final product quality and higher safety standards from mutually beneficial total quality management schemes;

- reduced conflicts through improved communication among the members of the project team and more efficient working and greater productivity as a result of continuous improvement;

- increased innovation, research and development from sharing of ideas and pooling of resources in strategic partnering arrangement; and

- reliable workload over agreement period and hence, elimination of tendering costs which would have normally be incurred in securing other projects within the period.

Major disadvantages of partnering include:

- incurring of additional cost in staff training workshops and extra management time;

- the possibility of the client's inability to provide continuous flow of work to partners and, therefore, leave them in financial difficulty;

- the tendency for cosy relationships leading to lack of new and innovative ideas and approach to the management;

- difficulty in maintaining staff commitment at the early stages of the project when the benefits of partnering are not so obvious; and

- possible conflicts between partnering charter/framework and the terms and conditions of the formal contracts between the various parties involved in the project.

2.4 REVIEW OF PROJECT DELIVERY PERFORMANCE

The introduction of more integrated forms of procurement over the years in the construction has not comprehensively improved the performance of the industry. The structures for the various parties to work together have been put in place but traditional attitudes and culture have prevented them to work as collaboratively as expected to lead to improved performance (Masterman 2002; Morledge 2002; Ndekugri and Turner 1994; Payne et al. 2003). The continued review of the industry's performance over half a century has also put project delivery within the UK construction industry under scrutiny as continued clients' overall dissatisfaction still exists. The response has resulted in publication of Government/Client-initiated reports and academic research all aimed at performance improvement. The continued development of performance measurement frameworks and redefinition of performance criteria attest to limited success of both industry and academic in addressing the poor delivery performance of the industry (Beatham et al. 2004; Cain 2004; Constructing Excellence 2004a; Egan 1998). The industry still struggles with what clients want and clients are constantly complaining about the industry's inability to meet their needs. The difference in expectations can be linked to the perceptions of these two sides of the construction industry on what a successful project really is. Definitions of project success have been populated with both

objective and subjective components and have continued to generate debate as there is no one single measure of success.

2.4.1 THE NEED FOR PERFORMANCE MEASUREMENT

The issue of performance measurement has been a persistent one, especially, among client's representatives, consultant and contractors of the construction industry. This is primarily due to the continuous call for the industry to radically change and improve traditional design and construction processes. Also, improvement process starts with an objective measurement of current performance. This measurement is also required to give an indication of how well an organisation or individual is performing in any given task, project or assignment (Cain 2004).

In the construction industry, performance measurement has been approached either in relation to the product as a facility or to the creation of the product as a process. Traditionally, cost, time and quality have been the indicators of performance used in the UK construction industry. In recent years they have been seen to provide only an indication of success or failure of a project. The traditional performance indicators in isolation, therefore, do not provide an adequate and balanced view of the project performance. They are also implemented at the end, instead of the beginning of the project. The traditional performance indicators are, therefore, lagging rather than leading (Kagioglou et al. 2001).

Cain (2004) outlines the importance of performance measurement in construction as it:

- is the only way of objectively locating the precise causes of ineffective utilisation of resources for their elimination. The entire design and construction supply chain team must work together to be able to effectively reveal ineffective resource utilisation. This require the setting aside of traditional thinking and working;

- is the essential first stage to any real, and long-lasting improvement process with tangible benefits form higher profit margins and whole-life quality of the

constructed product. It, therefore, reveals the truth about how well an organisation is doing which can be a motivation to tackle unnecessary costs;

- enables top management to fully understand conditions at site level and assess the real barriers to effective resource utilisation. It provides objective evidence and magnitude of disruption and reworking on site and the subsequent utilisation of the appropriate knowledge and skill in their resolution; and

- is an effective way of determining and proving to other end-user clients, whether a firm is achieving near maximum levels of effectiveness.

2.4.2 PERFORMANCE FRAMEWORKS

The integration of teams is expected to lead to improved performance in project delivery. Performance improvements can be better justified, substantiated, improved and maintained when they are demonstrable. This is particularly important at a time when investment for research and development within the construction industry is low (Fairclough 2002). The establishment of frameworks that can objectively measure performance to an acceptable standard will ensure that performance improvement can be assessed. Measurements showing positive and objective improvements will encourage sceptical senior management to commit to introducing these frameworks, especially when investments in team related issues do not often yield direct and immediate returns but rather long-term and sustainable returns. The implementation of these frameworks and subsequent measurement presents a challenge to the project delivery team that usually come together for a relatively short period but is still expected to perform to high levels associated with existing teams.

Performance measurement itself is important to any business organisation as it reveals its level of success. The inadequacy of traditional financially based performance measurement has resulted in the introduction of non-financial measures. These have significantly increased the amount of research in performance measurement. The result is the existence of several frameworks that have been

developed to help measure the performance at both project and organisational levels. The application of performance frameworks within the UK construction industry is still in its early stages and lessons are still being learnt in the usage. They each look at performance measurement from different perspectives (Bassioni et al. 2004; Cain 2004; Kagioglou et al. 2001)

The most frequently used contemporary performance frameworks in the UK construction industry are the Balance scorecard and European Foundation for Quality Management (EFQM) Excellence (Bassioni et al. 2004). These exist in addition to other performance improvement methods such as benchmarking, activity-based management and just-in-time (JIT), total quality management (TQM), and total productive maintenance (TPM).

2.4.3 BALANCED SCORECARD

Traditional performance measures are insufficient to gauge performance and guide organizations in today's rapidly changing, complex economic landscape. Organizations, therefore, need to link performance measurement to strategy, and must measure performance in ways that both promote positive future results and reflect past performance. The Balanced Scorecard is an approach to describing and communicating strategies. It is also a way of selecting performance measures that will drive a unique organizational strategy. It is a system linked with objectives, measures, targets and initiatives. The Balanced Scorecard is, therefore, a collective description of an organisational strategy and how it is achieved (Bloomfield 2002; Kaplan and Norton 1996; Mooraj et al. 1999).

Balanced scorecard has emerged, in recent years, as a strategic control tool for driving performance in organisations. The tool was initially developed Professor Robert Kaplan and David Norton as a performance management tool in 1990 at the Harvard Business School, Boston. It has evolved from a radical performance measurement tool to a comprehensive strategic management tool (Hepworth 1998). It provides managers with the instrumentation they need to navigate to future competitive success. The tool transforms strategic management paradigms by emphasising on enablers rather than results (Kaplan and Norton 1996).

The balanced scorecard has gained prominence in the construction industry because it conforms to the industry's move away from solely financial performance measurement approaches which are insufficient to gauge performance and guide organizations in today's rapidly changing, complex economic landscape. The tool, however, emphasises that financial results are obtained by successful implementation of strategic initiatives in key business perspectives rather than their driving force (Mooraj et al. 1999).

The balanced scorecard, as originally designed, has four perspectives: the financial; the customer; the internal-business-process; and the learning and growth. These perspectives represent shareholders, customers and employees. It represents a holistic view of the organisation. A balanced scorecard framework is shown in Figure 2.10.

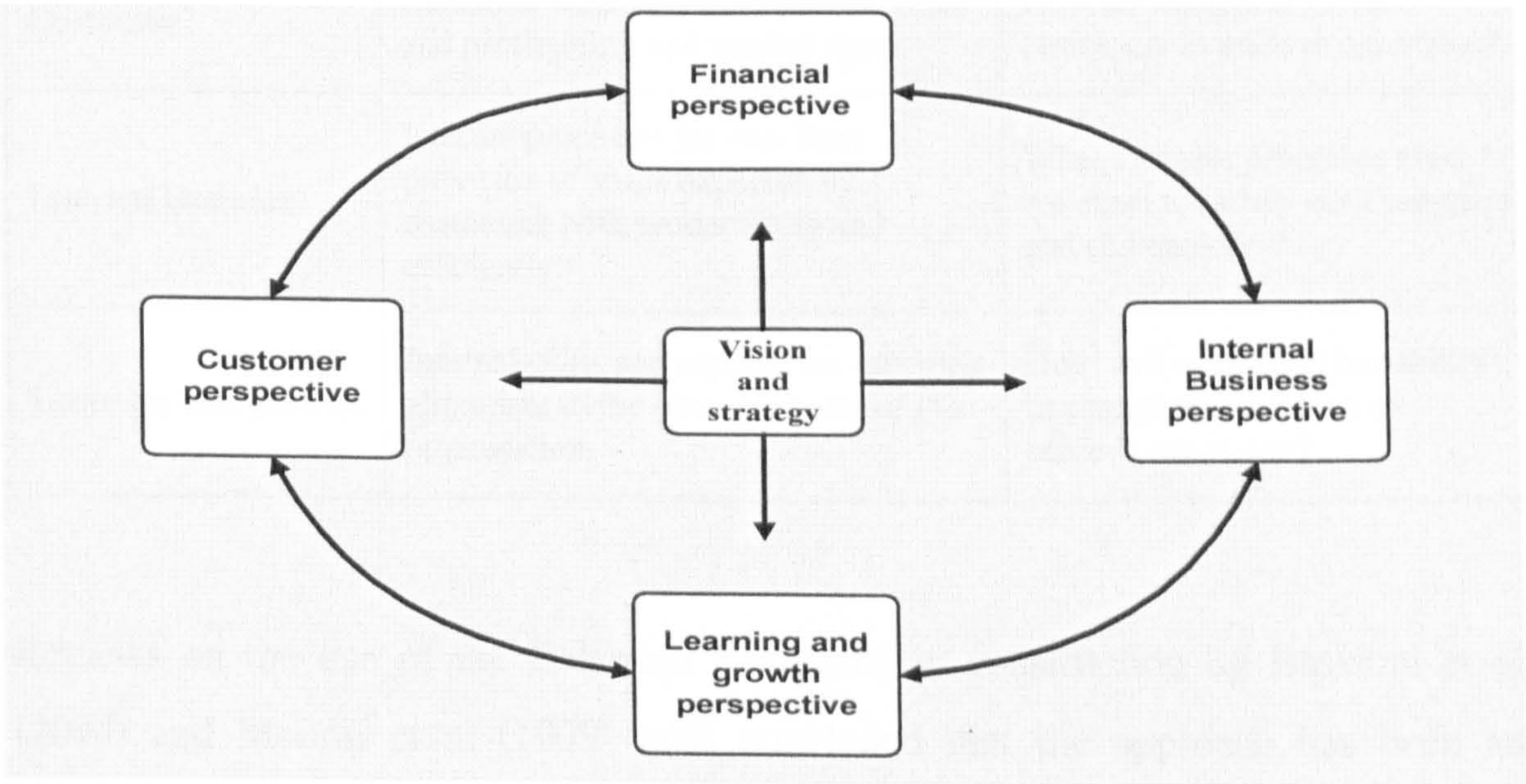

Figure 2.10 The Balanced Scorecard Framework (simplified illustration)

Source: Kaplan and Norton (1996)

Each perspective can be explained by a key question and the answers to each key question become the objectives associated with that perspective. Performance is then judged by the progress to achieving these objectives. There is an explicit causal relationship between the perspectives: good performance in the Learning and Growth objectives generally drives improvements in the Internal Business Process objectives, which should improve the organization in the eyes of the customer, which ultimately leads to improved financial results (Bloomfield 2002).

Though there are four basic perspectives proposed, it is important to understand that these perspectives reflect a unique organizational strategy. So the perspectives and key questions should be amended and supplemented as necessary to capture that strategy (Bloomfield 2002; Mooraj et al. 1999). Table 2.3 is a summary of the four perspectives of the balanced scorecard approach.

Table 2.2 Perspective of the Balanced Scorecard approach

Source: Mooraj et al (1999) and Bloomfield (2002)

Perspective	Scope definition	Key Question/Objective
Financial	Long-term objectives of the company based on sales volume, return on investment and payback period and revenue volume.	How should we appear to our stakeholders to be financially successful?
Customer	Customer satisfaction, retention, value and profitability and market share.	How do we appear to our customers to achieve our vision?
Internal business	Internal processes for excellent provision of value expected by customers both productively and efficiently.	What business processes must we excel to satisfy our customers and shareholders?
Learning and growth	Internal skills and capabilities and their alignment to the strategic goals of the organisation.	How will we sustain our ability to change and improve to achieve our vision?

Reviews on the use of the Balanced Scorecard in construction by Bassioni et al (2004) and Mooraj et al (1999) both concluded that the approach has been an excellent contribution to performance measurement. It would not, however, on its own bring about improvements in the long-term competitiveness and profitability in an organisation, which is what the UK construction industry has been called upon to achieve.

2.4.4 EFQM EXCELLENCE MODEL

The EFQM excellence model was first introduced in 1992 as a non-prescriptive framework for assessing applications for the European Quality Award. It is based on five enablers, which cover organisational activities and four results which cover organisational achievements. The principle of the model is that, organisational

achievements are caused by the activities carried out within. The activities undertaken by the organisation are then improved using feedback from previous achievements (EFQM 2003).

The model is based on the following premise:

"Excellent results with respect to Performance, Customers, People and Society are achieved through Leadership driving Policy and Strategy, that is delivered through, People, Partnership and Resources, and Processes" (EFQM 2003).

Figure 2.11 shows the details of the EFQM Excellence Model

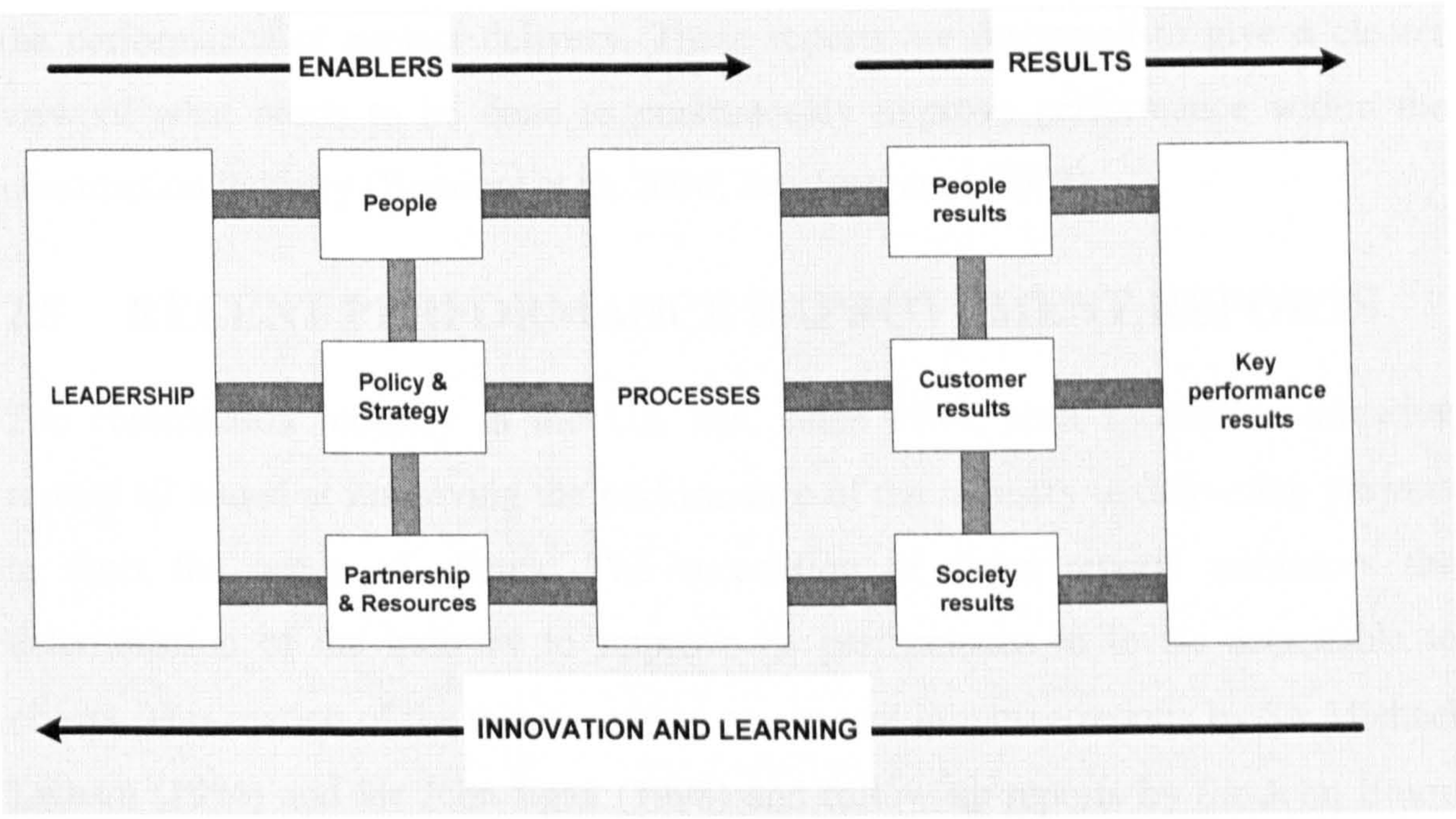

Figure 2.11 EFQM excellence model

Source: EFQM (2003)

There are a number of ways in which the EFQM Excellence Model can be used. The model, according to EFQM (2003), can be used as a self-assessment tool. It can be used for benchmarking other organisations and to identify areas of improvement. The EFQM Excellence Model provides the basis for common vocabulary and a way of thinking and the structure for an organisations management system.

The EFQM Excellence Model has been used by many organisations for both quality awards and as a management system and the associated growth in organisational

self-assessment. The model has been used to measure organisational paths to excellence through the understanding of gaps and simulations of solutions. It has subsequently received wide applicability in many industries (Jackson 1999).

The construction industry, seeking to improve the performance of project delivery, has used the EFQM model (Bassioni et al. 2004). The increased use is due to the clearer and more comprehensive enabling factors within the model as compared to the Balanced Scorecard. Construction firms have also found the determining and monitoring factors easier to use. The development of more frameworks is likely to continue as the construction industry strives to continuously improve its performance to acceptable. Many reports industry have attempted to suggest ways of improving the performance of project delivery. These reports are discussed to give a clearer view of what needs to be done to continuously improve performance within the construction industry (Bassioni et al. 2004; Beatham et al. 2004).

2.5 RECENT PERFORMANCE IMPROVEMENT REPORTS

The construction industry in the UK has, since 1944, seen successive initiative reports all aimed at improving the performance of the industry in delivering projects to meet the needs of clients. The succession of these reports reinforces the determination of the industry to improve its performance to levels acceptable to clients. This section of the thesis reviews two recent initiative reports by Sir Michael Latham (1994) and Sir John Egan (1998) and follow-up reports by Sir John Bourn (2001) and Sir John Egan (2002), which set and defined targets to be achieved by the industry and assessed through the use of performance measurement techniques.

2.5.1 OVERVIEW OF REPORTS

The construction industry has since seen 13 formal reports between 1944 and 2000, and a number of spin-off reports, which has led to a change in the willingness to provide implementation vehicles. In recent years, learning skills have also been developed to act upon reports. Reports published between 1944 and 1980 were mainly been driven by Government or parastatal clients who controlled the majority of construction works. Private clients and construction employers, wishing to

redesign the boundaries and rules for conducting business between themselves and the state, have been responsible for reports since 1980 (Murray and Langford 2003).

The reports have continuously addressed the fragmentation within the construction industry which has separated design from construction. According to Murray and Langford (2003) the reports have been aimed at improving the performance of the industry. This improvement was to be achieved through the encouragement of a change in the relationships between the parties to the construction process. This has resulted in the publication of a new report every 3 to 5 years. These reports have research based contents and offered new insights into the workings of the construction industry and the relationships that underpin it. Findings of these reports were, thus, implemented by the parties connected with the industry (Murray and Langford 2003).

Reports indicate that recommendations of these construction reports have been successfully implementation within industry. This is contrasted by the continued increasing search for improved performance by clients (Murray and Langford 2003). Actual examples of significant achievement have also been limited to projects set up specifically to demonstrate that targets and recommendations of the reports are realistic. There is industry-wide lack of projects that have achieved the results expected (Egan 2002). The contribution of this research is to identify exemplary project delivery team performance outside of these demonstration projects. This is to highlight the existence of good practices that have to be maintained and unacceptable practices that have to be improved for the better.

2.5.2 LATHAM REPORT – CONSTRUCTING THE TEAM (1994)

Background

The "Constructing the Team" Report (Latham 1994) was the final report on the consultation process of the Joint Review of Procurement and Contractual Arrangements in the UK Construction Industry which began in 1993. The report was commissioned jointly by the Government and Industry, with the invaluable clients' participation. Sir Michael Latham submitted that the report was the personal, independent and friendly view of an observer. The Latham report was funded by the

Construction Industry Council (CIC), The Construction Industry Employers Council (CIEC), the National Specialist Contractors Council (NSCC) and the Specialist Engineering Group (SECG) (Latham 1994).

The report was commissioned in a particularly difficult time for the UK Construction Industry as the economic recess was at its peak. Monetary policies were tightened and that affected the volume of work in the industry and increased competition. The general trend in the industry was for contractors and consultants to bid low for projects and make high claims during the execution phase. The practice increased conflicts and led to more adversarial attitudes within the industry. Consequently, many clients were dissatisfied the performance of the industry. The report advocated for the replacement of adversarial relationships within the construction with cooperation. The report argued that an improved performance of the industry is more likely to be achieved in the healthy atmosphere (Cahill and Puybaraud 2003).

Key recommendations

The Latham Report (1994) identified 30 key recommendations that were intended to be taken as a package. The report anticipated that participants in the construction process would react to the recommendation in any of the following three ways (Latham 1994):

- complete rejection of the report;
- picking of sections that suits participants and rejection of the remainder; and
- acceptance and working through the implementation structures recommended by the report.

The report implementation meant that business practices would become more efficient and provide better definition of needs and objectives. This would result in a clearer framework of roles and responsibilities of the project participants and a more stable construction environment (Cahill and Puybaraud 2003).

A review of the Latham report by Cahill and Puybaraud (2003) identified the following as the key recommendations:

- a productivity target of 30% reduction in real construction cost reduction by 2000 as a motivating factor for the implementation of all the other proposals in the report;

- the clear establishment of Government as the best practice client which would set an example for other clients to follow;

- the production of a client's guide to briefing to assist all clients in understanding and being involved in the drawing up of briefs for projects;

- the preparation of a construction code of practice to provide a guide on best practice, including contract strategy, tendering and project management;

- the introduction of a complete standard family of contract documentation enshrining the basic principles set out in the report;

- the rationalisation of the system by which construction companies were asked to prequalify for contracts; and

- the development of mechanisms for the selection of consultants which would allow both price and quality to be given appropriate considerations.

Impact of report

The Latham Report meant that legislation had to be modified and adapted to address the wider needs of the construction industry. Significantly, The Housing Grants, Construction and Regeneration Act 1996 emerged from the recommendations of the report. The intention of the Act was to give the parties to a construction contract the right to a speedy, impartial and moderate dispute resolution process and number of rights and responsibilities relating to payments. The process was to be binding on all parties but could be challenged in a court or at arbitration.

In relation to contracts, the recommendations of the Latham report meant that standard forms of contract in the UK had to be reviewed to make them simpler and non-adversarial and improved to enable the easy implementation of better working practices. This was to be achieved through the introduction of partnering to reduce conflicts and disputes among the participants in the construction process.

As a result of the recommendations of the Latham report, more in-depth reviews of the procurement practice within the industry has been carried out, leading to the publication of a number of good practice guidelines. Partnering, used to reduce the risks and possibilities of disputes in complex project, has consequently gained popularity. This is due to the climate created as a result of the Latham report within the UK construction industry.

2.5.3 EGAN REPORT – RETHINKING CONSTRUCTION (1998)

Background

Four years after the Latham report, the Construction Task Force headed by Sir John Egan, submitted a report to the Deputy Prime Minister of the UK on the scope for improving the quality and efficiency of construction. The report, Rethinking Construction (1998) was designed to build upon the recommendations of the Latham Report (1994). This was a report for the Government by the industry's leading clients. Significantly, it excluded the contributions of contractors and the client focus of the report has often attracted some criticisms.

The Rethinking Construction Report (1998) was published at a time when there was a strong Government support for financing public procurement. The promotion of non-adversarial culture within the construction industry was also at its peak. Many top UK contractors, however, continued to flout construction legislations such as the Construction Act. Cultural changes within the industry had also increased concern for environmental issues resulting in the introduction of the "sustainable construction" concept. Poor health and safety records were widespread and the negative image of the industry resulted in low recruitment levels in the industry. Another key characteristic of the era was the development of cooperative project relationships. Many clients had thus moved from one-off to continued project

partnering arrangement which laid the foundation for supply chain management (Murray 2003).

Key recommendations

The main thrust of the recommendations of the Rethinking Construction Report (1998) was the need for continuous and sustained improvement of the construction industry to deliver value to its customers. The report highlighted the unacceptably high level of waste from working practices and poor quality of existing structures. Egan (1998) called for a commitment to change and collaborative working to create a modern construction industry. The Egan report emphasised the excellent capabilities of the industry to deliver difficult and innovative projects. It indicated that the industry as a whole was under-achieving and that clients were dissatisfied with the overall performance of the construction industry.

The Egan Report (1998) concluded that, through the application of best practices, the industry and its clients can collectively act to improve their performance. The Rethinking Construction report:

- identified key drivers for change within the construction industry;
- set targets based on experience and evidence from both UK and overseas projects; and
- proposed strategic changes for improved project delivery process.

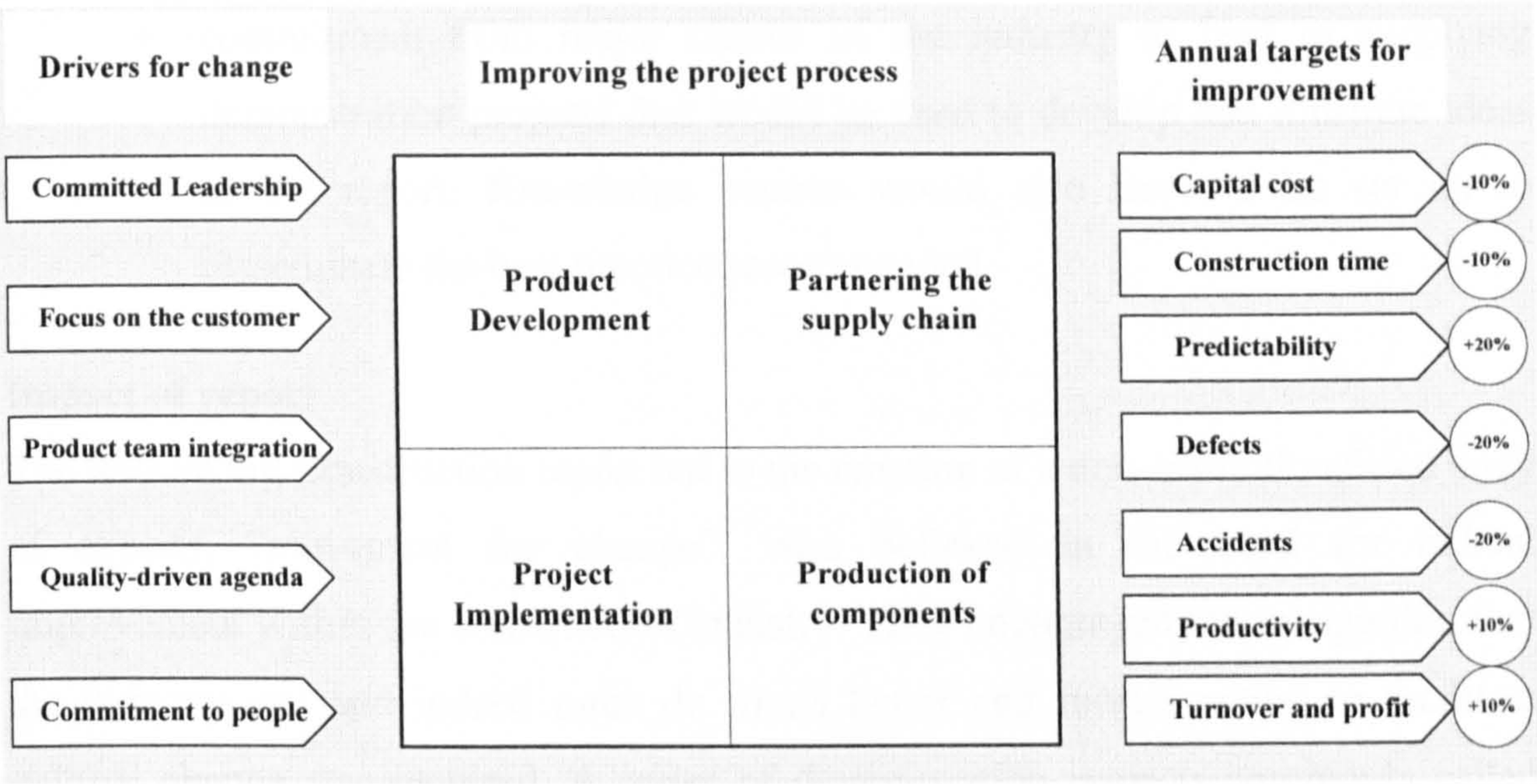

Figure 2.12 The Egan agenda for change

Sources: Egan (1998) and Murray (2003)

The Egan report (1998) addressed six key issues and a review by Murray (2003), highlighted these as:

- modernisation of the construction industry through a radical change in the way the industry builds through the adoption of techniques, such as concurrent engineering, from other industries;

- setting of clear and measurable objectives and continuously achieving targets set for improvements;

- improvement in the project process by learning from other industries such as manufacturing and the integration of the various components of the construction process into a complete supply chain;

- cultural changes in the industry leading to an improvement in welfare of workers, good-quality training, long-term relationships and alliances based on trust;

- the establishment of a housing forum that would enable the private and public sectors to share innovative ideas between themselves towards improvement through social housing; and

- commitment from major clients of the industry to lead in supplying demonstration projects that would be used to develop and illustrate ideas in the report. Knowledge centres would also have to be set up to disseminate the best practice recommended.

Impact of report

The Rethinking Construction report led to the creation of a non-institutionalised body of experts, "movement for change", who believed in the need for radical improvement within the construction industry. They encouraged the recognition that the industry can and indeed must do much better and further action to facilitate cultural change was required. A series of demonstration projects commonly called "Movement for Innovation (M4I)" have also been set up to exemplify some of the innovations advocated in Egan report. According to a report by the Rethinking Construction Ltd (2001), many of the Demonstration Projects have exceeded targets in productivity, profits, defects and reduced accidents set out in the report. Costs are 10% lower and projects are executed 40% safer than the UK industry average.

Table 2.3 Construction Industry KPIs

Source: Construction Best Practice (2004)

Level of measurement	Key Performance Indicator	Definition
Project	Construction cost	The normalised construction cost of a project in the current year less the cost of a similar project one year earlier, expressed as percentage of the construction cost one year earlier.
	Construction time	The normalised construction time of a project in the current year less the time of a similar project one year earlier, expressed as percentage of the construction time one year earlier.
	Design and construction cost predictability	The sum of the actual cost available for use (C), less the estimated cost at commit to invest (A), expressed as a percentage of the estimated cost at commit to invest (A) and actual cost available for use (C), less the estimated cost at commit to construct (B), expressed as a percentage of the estimated cost at commit to construct (B).
	Design and construction time predictability	The sum of the actual duration at commit to construct (X), less the estimated duration at commit to invest (Y), expressed as a percentage of the estimated duration at commit to invest (Y) and actual duration at available for use (Z), less the estimated duration at commit to construct (Y), expressed as a percentage of the estimated duration at commit to construct (Y).
	Defects	Condition of the facility with respect to defects at the time of handover using a scale of 1 to 10, with 10 as defect-free and 1as totally defective.
	Product satisfaction	The level of satisfaction of the client with the finished product/facility using a scale of 1 to 10, with 10 as totally satisfied and 1 as totally dissatisfied.
	Service satisfaction	The level of satisfaction of the client with the services of the consultant and main contractor using a scale of 1 to 10, with 10 as totally satisfied and 1 as totally dissatisfied.
Company	Profitability	Profit before tax and interest expressed as a percentage of sales.
	Productivity	Company value added per employees (£000s).
	Safety	Reportable accidents per 100,000 employed per year.

Murray (2003) points out in his review of the Egan report (1998) that, performance indicators in the UK construction industry prior to the publishing of the Egan report was very limited. Project performance in terms of efficiency and quality were,

therefore, difficult to obtain. The publishing of the Rethinking Construction report led to the emergence of key performance indicators (KPI), discussed in Section 2.4.2.1 of this thesis, to be used for an industry-wide performance system that differentiated between the best and the rest and also provided a rational basis for the selection and award of excellence. In all Ten KPI's were developed and the details are summarised in the Table 2.3.

2.5.4 MODERNISING CONSTRUCTION REPORT (2001)

Background

A number of reports have been published in the UK within the past half decade as follow up of the "Constructing the Team" and "Rethinking Construction" reports. These reports are not new initiatives but build upon the recommendations and reinforce the principles set out in previous reports. One of such reports is the "Modernising Construction" report (Bourn 2001) by the Controller and Auditor General at the National Audit Office which scrutinises public spending on behalf of the Parliament. The report, published in 2001, was prepared under Section 6 of the National Audit Act 1983 of the UK for presentation to the House of Commons in accordance with Section 9 of the same Act.

Highlights

The "Benchmarking Study" (1999) on the performance of construction projects by departments and agencies showed that 73% of projects were over budget and 70% delivered late. This poor performance had been blamed on the adversarial relationships between parties in the construction process. This has resulted in calls for the integration of the entire supply chain to improve buildability and reduce waste. The "Modernising Construction" report builds on the central theses of the Latham and Egan reports. The report poses a challenge to the construction industry to improve construction performance. It also calls for an improvement in the performance of departments and contactors and make recommendations on construction procurement and management.

The Bourn report identified six requirements of procuring and managing construction including maintenance and refurbishment. These requirements were recognised as

important for procuring and managing construction better and departments and agencies. The requirements are summarised in Table 2.4.

Table 2.4 Key requirement of procuring and managing construction

Source: Modernising Construction Report (2001)

Requirement	**Explanations**	**Illustration**
Contractors selection to be based on long term achievement of sustainable value for money.	The lowest tender price will not guarantee value for the full life of the building.	Balancing quality and price by the Highway agency.
Construction design should be integrated with the whole construction process.	Consultation with the end user in developing the design and involving the main contractor.	Integrating the design team - Building Down Barriers by Defence Estates, Laing and AMEC.
Sufficient planning time before the commencement of construction work on site.	Good planning leads to improved construction sequence; risk assessment and management; and value management.	Benefits of planning by Dudley Southern Bypass.
Reliable project management need to be in place.	Comprehensive understanding of key stages, risk, monitoring and communication.	Good project management by Kingston Hospital.
Measurement of cost, time and quality requirements for learning and future projects.	The measurement to assess whether targets are being met and lesson learnt for dissemination on future projects.	Measuring performance (external benchmarking and performance measurement framework) by Defence Estates.
Remuneration of contractors to incentivise them to deliver quality construction on time and to budget.	Mode of remuneration of contractors can influence performance but careful judgement is required to ensure value for money.	Agreeing a target price by The Environment Agency Beach Management project.

Recommendations

The Bourn report concluded with recommendations to The Department of the Environment, Transport and the Regions (DETR), the Office of Government Commerce (OGC) Line departments and the construction industry. These recommendations were:

- the provision of more co-ordinated direction by DETR to initiatives to promote better performance by the construction industry;

- DETR to use its influence as a member of M4I board to ensure that demonstration projects are truly innovative;

- the development of more supplicated performance measures by DETR on whole running cost of completed building, cost effectiveness of the construction process, quality of the completed construction, and health and safety indicators;

- dissemination of good practice more widely by OGC to reach smaller organisations that funding indirectly;

- line departments to actively measure improvements in construction and train more staff to be effective construction clients; and

- the construction industry to make greater use of innovation to improve public sector construction quality and cost effectiveness of buildings.

2.5.5 ACCELERATING CHANGE REPORT (2002)

Background

The "Accelerating Change" report (2002), according to Sir John Egan was not a new initiative but a publication that builds on and reaffirms the principles set out in the "Rethinking Construction" report (1998). The "Accelerating Change" report was an outcome of a forum, The Strategic Forum for Construction (SFC), set up to tackle the barriers to progress and identify ways to accelerate change within the construction industry. The arrangement for SFC was announced by Brian Wilson, Minister for Construction in the UK and the forum was chaired by Sir John Egan.

Highlights

The "Accelerating Change" report (2002) highlighted key measures that had to be taken by the construction industry to accelerate the necessary changes within the

industry to make it more productive. The report comprised a vision, strategic targets, future actions by the forum (SFC) and others, and recommendations.

The vision, as expressed in the report, was for the construction industry to realise maximum value for parties involved in the process and consistently deliver world class products and services that exceeded expectations. The construction industry, therefore, has to exploit and add the economic and social value of good design to products delivery to become more profitable and earn resources for future investments. The built environment was also to be enhanced in a sustainable way to improve the quality of life. The report further called for integration of the supply process, respect for people, culture of continuous improvement through performance measurement and investment in research and innovation. The forum set the following targets in Table 2.5.

Table 2.5 Strategic targets set by the SFC

Source: Accelerating Change report (2002)

Strategy description	**Initial targets**		**Future targets**	
	Value	**Year**	**Value**	**Year**
Construction projects undertaken by integrated teams and supply chains	20%	2004	50%	2007
Client activity by value embracing the principles of the Clients' charter	20%	2004	50%	2007
Development and implementation of strategies to recruit and retain qualified people	300,000	2006	450,000	2007

The report further highlighted that the SFC will put in place means of measuring progress towards its targets. They should also ensure the development of a toolkit to help clients and individual within the supply chain to assemble integrated teams, mobilise their value streams and promote effective team working and then produce an action plan to promote its use. Models for payment mechanisms and KPIs for payments will be produced. A review of people initiatives will be undertaken and a

code of good practices to be adopted by clients, employees, employer and trade unions will be developed by the SFC.

The Construction Best Practice (CBPP) programme was then set up to develop, collate and share tools and activities towards SMEs to support them in their development as part of the integrated supply team. Change in productivity improvement will be accelerated by collating and sharing current best practices in logistics. A wide range of Discussion Document will be published by the Health and Safety Executive (HSE) to explore various levels to achieve cultural changes in the industry to benefit health and safety performance.

Recommendations

The "Accelerating Change" report made a number of recommendations that called for improved understanding of construction and business needs and how that can help in the creation of integrated teams. The report singles out integrated working as key to improved performance within the construction industry. The key recommendations in the report were:

- the promotion of the value of independent advise between industry and the government, which will assist clients realise value for money;

- the use integrated team and long-term supply chains and active client participation in their creation, review and signpost of existing process maps to encourage those who wish to participate in integrated teams;

- the availability of basic competences and a code of conduct to ensure client can expect to receive adequate, consistent and independent service and creation of an environment throughout the project by clients which delivers excellence in health and safety performance;

- development of an education and training package in supply chain integration and collaborative working;

- availability of project insurance to underwrite the whole team and the examination of the impact of insolvency law and practice on construction supply chain;

- widespread use of the Respect for People toolkit and addressing issues with pay and working conditions to attract and retain high calibre professionals in the construction industry; and

- development of closer working relationship between industry and academia offering advice and support at both design delivery stages of construction projects.

2.6 SUMMARY

The construction industry contributes ten percent of UK GDP and employs 1.5 million people. The industry is large and complex and is distinguished from industry by the nature of product, clientele, production and delivery methods. The product of the industry, known as a project, is delivered using separated or traditional, integrated, management-oriented or discretionary procurement system. These systems dictate the relationships that exist between the parties involved in the delivery process. The fragmentation of the industry has been blamed on the traditional procurement system but more systems have been introduced in the industry to encourage integrated processes and collaborative working.

The construction industry has subsequently introduced a number of performance measurement frameworks in an attempt to highlight demonstrable improvement in initiatives taken to address the poor performance of the industry. Balanced Scorecard and EFQM Excellence Model have been used within the industry to measure performance in a more comprehensive approach than previously existing financial based measurement systems. Successive reports by the industry have, however, continued to challenge the industry to improve its performance in the delivery of projects. This is because time and cost overruns are still prevalent in the industry. Traditional attitudes continue to fragment the project delivery process and have prevented the various teams in the industry to work together effectively. Two recent

initiatives and follow up reports have all called for the encouragement of collaborative working practices and non adversarial attitudes through the formation of integrated project teams and processes.

In spite of claims of successful implementation of successive industry reports, examples of team integration for improved performance are still limited to demonstration projects set up to highlight benefits of these reports. Fragmented and inefficient teamwork practices exist in many other projects because clients still complain about project performance. Good integration practices can be identified through exemplary usage of teams within industry. This is necessary to improve the level of confidence in moving towards integrated team effort for improved performance. Chapter Three reviews further literature on improving performance through the concepts of team, teamwork and integration.

CHAPTER THREE - TEAM, TEAMWORK AND INTEGRATION

3.1 INTRODUCTION

Chapter Two concluded that performance of project delivery within the UK construction industry was poor, however, teams involved in project delivery can be integrated to improve their performance. This chapter reviews the concepts of team, teamwork and integration in organisations. These various dimensions of team integration are required for improved project delivery performance in order to respond to the challenges previously discussed in Chapter Two.

The terms "team" and "group" are defined and distinguished to clarify their usage throughout the thesis. Teamwork and integration are also defined. A thorough review of teams in organisation, how they are developed, roles within a team, problems encountered during the development stages and the characteristics of an effective team are presented. The concepts of "teamwork" and "integration" are introduced and their suitability to the construction project delivery environment discussed. The need, approaches and barriers to the concepts are also reviewed. The chapter concludes by identifying further research that needs to be conducted on the integration of teams for improved project delivery

3.2 DEFINITION OF TERMS

Key definitions of terms used throughout the chapter are defined in this section. This is to clarify their usage, especially where the terms are sometimes used interchangeably or in a context different from what it is in this chapter and throughout the thesis.

3.2.1 TEAMS AND GROUPS

The distinction between teams and groups is often unclear, although the terms "team" and "group" have been used to describe rather different entities (Brannick and Prince 1997). Though teams share some common characteristics with groups, such as membership, norms and cohesion, they are fundamentally different (Hayes 2002). The term "team" is familiar but insufficient attention is normally given to its use by incorrectly referring to what are in fact groups of people as teams. This often gets in the way of learning and applying appropriate team disciplines that are necessary for good performance. To improve the appropriate use of the term team and to understand how teams perform well, it is important to identify the key characteristics that distinguish teams from a group (Katzenbach and Smith 1993).

A team is defined by the roles and tasks to be performed by members. The purpose for its formation is specific to the team. The leadership role can be nominated to an individual but there is an expectation that all members can contribute in some way or another to the leadership of the team. It requires both individual and collective accountability. The key distinction hinges on performance, which is expected to be greater than the sum of all the individual members. Though teams rely on joint contributions of members to achieve the best results, the performances of individuals are critical to the overall performance of the team (Brannick and Prince 1997; Katzenbach and Smith 1993).

A group can be formal or informal. It is formal when the group is consciously created for a purpose and informal, when it is developed through interdependencies. Informal groups evolve from formal group settings within an organisation as members associate with one another. Organisations, therefore, concentrate on forming formal groups and create the necessary environment for informal groups to develop (Buchanan and Huczynski 1997). Formal groups are discussed and simply referred to as "groups." Groups are usually brought together for a specific purpose and members share information to reinforce individual performance towards achieving their goals and thus their performance is usually a function of what its individual members achieve. In a group, members tend only to be responsible and

accountable for their own performance (Brannick and Prince 1997; Katzenbach and Smith 1993).

The above definitions point to the fact that both teams and groups are made up of skilled individuals. They provide a means for the satisfaction of human needs. The key distinction is that teams are formed to achieve collective results whereas groups are usually formed to improve individual performance through collaborative learning. The purpose for a team will be specific to the team but it is general for a group and falls in line with organisational goals. Moxon (1993) submits that attributes such as common purpose, identity, interdependent functions and agreed norms or values distinguish a team from a group. These criteria are also used to describe an effective team.

In summary, a group is a collection of individually skilled people put together for a purpose. The group then develops into a team when it is tasked with a specific purpose and a common goal. The focus then shifts from helping individuals to achieve improved performances to working together to achieve a set target. A team possesses an atmosphere of participation, cooperation and sharing to enable problems to be analysed and solved collectively. Members work together in a supportive and complementary manner to achieve what cannot be efficiently or effectively achieved singly. Table 3.1 summarises the differences between teams and groups

The success or effectiveness of a team has often attributed to the presence of good leadership (Daft 1999; Nothouse 2004; Yukl 2005). This is because the team comprises people with different skill. A leader is needed to ensure that these skills are brought together to yield the output that will more than the sum total of the individuals. Leadership is required within a team to build and facilitate team learning and decision-making (Kolb 1995; Yukl 2005; Zaccaro and Banks 2001) Leadership is also needed to provide direction and guide the team through its development stages to maturity (Daft 1999; Kogler-Hill 2004; Zaccaro and Banks 2001).

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Table 3.1 Summary of differences between teams and groups

Sources : Brannick and Prince (1997), Buchanan and Huczynski (1997), Katzenback and Smith (1993) and Moxon (1993)

	Team	**Group**
Definition criteria	Roles and tasks by members with distinct functions	Specific purpose by members with interchangeable functions
Member size	Small, usually less than 25	Medium to large depending on task
Purpose	Specific to the team	General and in line with organisation
Identity	Individual recognise they belong to the same unit	Individual identities are kept
Leadership	Shared roles	Focussed leader
Accountability	Individual and mutual	Individual
Decision processes	Conclusive and carried out by team	Conclusive but passed on for action
Products	Collective	Individual
Performance measurement	Both collective and individual.	Influence of group on other individuals

3.2.2 TEAMWORK

The definition of team underlines the presence of people with a specific objective or recognised goal to attain. This means there must be a co-ordination of activities among members to attain the team goal (Conti and Kleiner 1997). Those behaviours of members that engender information sharing and coordination of activities within the team are collectively called teamwork (Dickinson and McIntyre 1997). This means that bringing people together does not necessarily ensure that they will function well as a team. There must be a synergetic process in which the efforts of the team members surpass individual efforts (Scarnati 2001).Teamwork is the co-operative and coordinated efforts by individuals working together in the interests of their common cause. It requires the sharing of skills and leadership, the playing of multiple roles (Harris and Harris 1996; Ingram *et al.* 1997). It enables effective tackling of complex problems by a pool of expertise, knowledge, skill and

experience. It also provides opportunities for employees to learn more about their jobs through participation in problem solving and decision-making. Ordinary people are subsequently able to achieve extraordinary results within a teamwork environment (Harris and Harris 1996; Scarnati 2001).

Teamwork is one of the most widely recommended tools for organizational transformation. It must, therefore, be supported by major changes in culture, structure and systems for success (Drew and Coulin-Thomas 1996). Teamwork aids team and departmental interface problem resolution and improves the quality of decision-making (Nesan and Holt 1999). It has an impact on productivity and the quality of services or products produced by a work group. High quality teamwork stimulates on-going innovations and encourages employee commitment. Productive and efficient teamwork provides an edge by being a sustainable competitive company asset (Golestani and van Zwanenberg 1996). Teamwork is thus vital if the desired organisational goals are to be achieved.

Understanding teamwork is a fundamental step in assuring future survival in an environment of increasing complexity of problems (Larson and LaFasto 1989). Effective teamwork can be measured by individual and group outputs which are a product of inputs, filtered and controlled by management who set up teams, and throughputs (Ingram *et al.* 1997). The importance of creating and improving the conditions for effective teamwork in an organization is evident in our present competitive world (Conti and Kleiner 1997).

In summary, teamwork can be defined as "the structured, cooperative and coordinated efforts by individuals or functional groups, working together in a balanced participatory manner, through the sharing of skill and information for their common interest and objectives". It occurs at interfaces to improve problem solving and decision-making and must therefore be supported by major culture changes, organisation structure and a working system.

3.2.3 INTEGRATION

In the construction industry, the word "integration" has been widely used to describe the concept of freely exchanging information between different participants in the construction process, though actual examples have been limited and localised (Vincent and Kirkpatrick 1995). In the opinion of Betts *et al* (1995) any concrete definition must address the "who, what, when and why" of integration to strengthen and give more meaning to the definition.

Integration, according to Howell (1996) and Jafaari and Manivong (1999) is the merging of different disciplines with different goals, needs and culture into a cohesive and mutually supporting unit encouraged to undertake a single task. This leads to working together to achieve a common goal through the sharing of information. The definition of integration outlines two key issues of sharing and exchanging of information. Davies (1995) viewed integration as merging individual and organisational goals into a single attainable project goal. It is also the alignment of various processes to conformity with each other (Dainty *et al.* 2001). Integration, therefore, gives the opportunity to incorporate several projects into a single structure (Austin *et al.* 2002).

Others have used integration to mean working in a collaborative manner and continuously improving team cultures and attitudes from professional backgrounds (Austin *et al.* 2002). Moore and Dainty (1999) used integration to mean working in a coherent manner to overcome structurally or culturally determined interfaces has been. In the opinion of Love(1998), integration can be used to describe the collaborative design development and conflict resolution in concurrent style by having a share in project development. Evbuomwan and Anumba (1998)defined integration as carrying out activities and operating in a comprehensive, structured and concurrent manner.

Summarising from the various definitions, integration can be defined as "bringing together different requisite and contributory functional disciplines to work in a continuous collaborative and cohesive manner to achieve more efficient and informed desired collective objectives."

3.3 THE USE OF TEAMS IN ORGANISATIONS

Teams have existed for years and many people believe they know how teams work and the benefits that can be derived from their usage. There are, also, countless personal experiences, both positive and negative, of involvement in teams. Research, however, indicates that the impact of teams on the performance of organizations is underexploited (Katzenbach and Smith 1993).

Team capabilities are also recognised by most people who have a common sense to make them work. There is, however, confusion about what makes a team perform. This is explained by the natural resistance to moving beyond individual roles and accountability. To overcome such resistance, "team basics" have to be applied thoroughly and comprehensively (Katzenbach and Smith 1993).

The team basics model is shown in Figure 3.1 below. Katzenbach and Smith (1993) submits that teams deliver what are described on the vertices of the triangle and the discipline required to make them happen are indicated on the sides and the inside. Team can deliver performance results that require and produce team behaviour by focussing on performance and team basics rather than becoming a team.

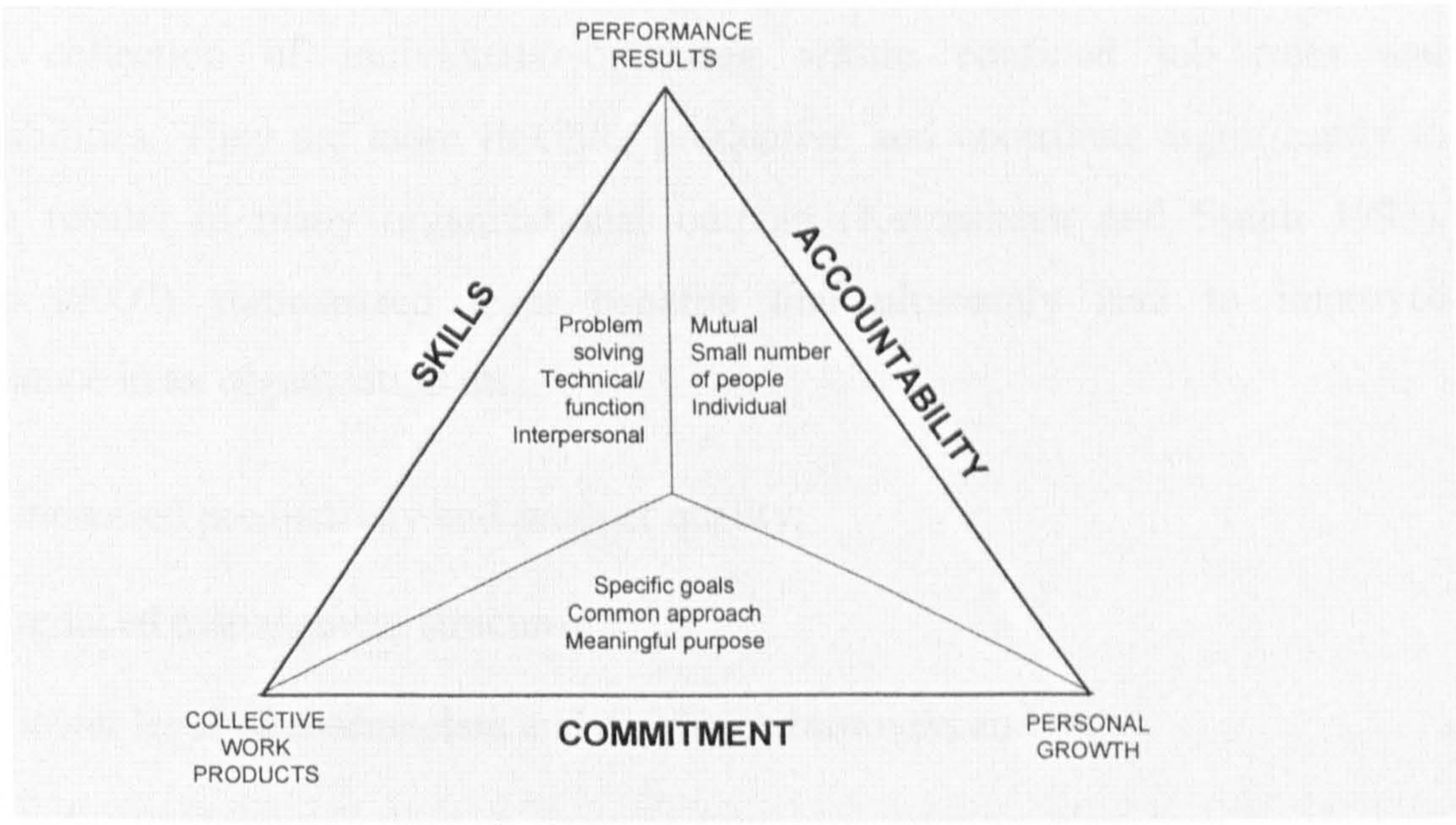

Figure 3.1 Focusing on team basics

Source: Katzenbach and Smith (1993)

3.3.1 THE NEED FOR TEAMS

Working in teams has become a fact of life and is here to stay. Teams are used in nearly all organisations in most sectors and industries due to the recognition that they are able to outperform individuals acting alone, especially when performance requires multiple skills and judgements. Teams have subsequently become the basic building blocks for many business organisations (Brannick and Prince 1997; Katzenbach and Smith 1993; Steward and Barrick 2000). Teams also enable the basic human needs of affiliation and belonging to be satisfied as outlined in Maslow's hierarchy of needs (Maslow and Frager 1987).

In response to industry trends, research on teams has significantly increased over recent years. Many of the studies have been aimed at identifying factors that influence performance, especially in the manufacturing sector, where performance improvement has been high on the agenda for some time. The results of such research have demonstrated that the use of teams frequently results in considerable performance improvement (Janz 1999; Pagell and LePine 2002).

Modern management has become increasingly focussed on teams, due to their enormous potential for increased productivity (Hayes 2002). Teams get better results than a collection of individuals operating within confined job roles and responsibilities. They are more flexible, productive and contribute significantly to tangible results in many organizational outputs (Katzenbach and Smith 1993). Glassop (2002) summarized team benefits that ultimately lead to improved performance in an organization as:

1. increased productivity and product quality;
2. reduced management structure;
3. lower level of absenteeism and employee turnover; and
4. industrial harmony through improved working relationships.

Successful teams are good for a company and its people as they integrate the individuals within the organisation. (Golestani and van Zwanenberg 1996). Teams

offer greater participation, challenges and feeling of accomplishment and, therefore, attract and retain people of high capabilities in an organisation within a given industry (Conti and Kleiner 1997). They provide an avenue for people to belong and associate with one another. This is becoming increasingly important, as people tend to look to satisfy some basic needs within their sphere of working environment. Inability to meet this need can negatively impact on productivity, even though structures for appropriate functioning within the team environment may be present.

Within a team, there tends to be a variety of knowledge and skills, which can be pooled along with information and resources that can be shared. Work can be checked for errors by different members of the team on a blame free basis (Driskell 1992). Teams are needed in organisations to engender improved performance. Several reasons have been given to the continued use of teams to achieve high level of performance.

Katzenbach and Smith (1993) indicated that teams perform better because they:

1. present a broader mix of skills and knowledge needed to respond to multifaceted challenges of innovation, quality and customer satisfaction;
2. are able to adjust better and quickly to new information due to the joint development of goals and approaches and the establishment of communication;
3. help build trust and confidence and provide the appropriate social dimension that enhances economic and administrative aspects of work; and
4. have fun and that helps members to deal with pressures and intensity of high performance required of them.

The complex nature and the presence of different skills in construction, previously discussed in Sections 2.2 and 2.3, means that teams are needed for success in construction (Bower 2003; Gould 2002; Harris and McCaffer 2003). This is because, the use of teams allow complimentary use of available skills to achieve high productivity, which cannot be achieved individually (Constructing Excellence 2004a; Conti and Kleiner 1997). This productivity, however, depends on how the team

develops as they come together at the commencement of the project. The next section of the thesis explores how teams develop and break up and the challenges and characteristics of each stage of development.

3.3.2 TEAM DEVELOPMENT

It is important to recognise that team do not stay for very long. To fully understand the concept of team and effectively implement its usage in an organisation, there is the need to explore how teams develop (Johnson 2001; Lewis 1996). Teams have a growth process that can be understood and described, although the stages of development do not follow a predictable step-by-step sequence of evolution. A pattern can be detected as an assembly of people goes through a development process to emerge as a team (Francis and Young 1992).

Teams are most effective when the members see themselves as working towards common objectives and realise that they have mutual interest. Effective teams take some time and often involve conflicts that must be worked through and sorted out. Conflict may arise on issues such as task to be undertaken and the people involved. Task issues include objective, purpose and ways of working. People issues may involve determining who is in the team, who is in charge and how much trust there is in the team (Lewis 1996).

Various stages of development are experienced within a group prior to its maturity into a team. Each stage is unique and is characterised by certain types of individual behaviours and issues that confront the team and its leadership. The reasons for progression from one stage of development vary according to the stage reached by the group. The rate of progression cannot be forced on the group. It is, therefore, up to the group to progress and that can be done quickly or slowly depending on the rate at which key issues are resolved (Moxon 1993).

Teams go through a series of stages before becoming fully developed. The stages were captured in a team development model by Tuckman (1965), initially, as a four-stage model. A fifth adjunct stage, relevant to the well-being of the people but not to the main task of management and development of the team, was later added as an

extension (Tuckman and Jensen 1977). The stage is particularly important to the teams in project-based sectors and is included in the review in this section. The five main team development stages areas follows.

1. **Forming (Collection).**

2. **Storming (Group).**

3. **Norming (Developing team).**

4. **Performing (High-performing team).**

5. **Adjourning (Mourning).**

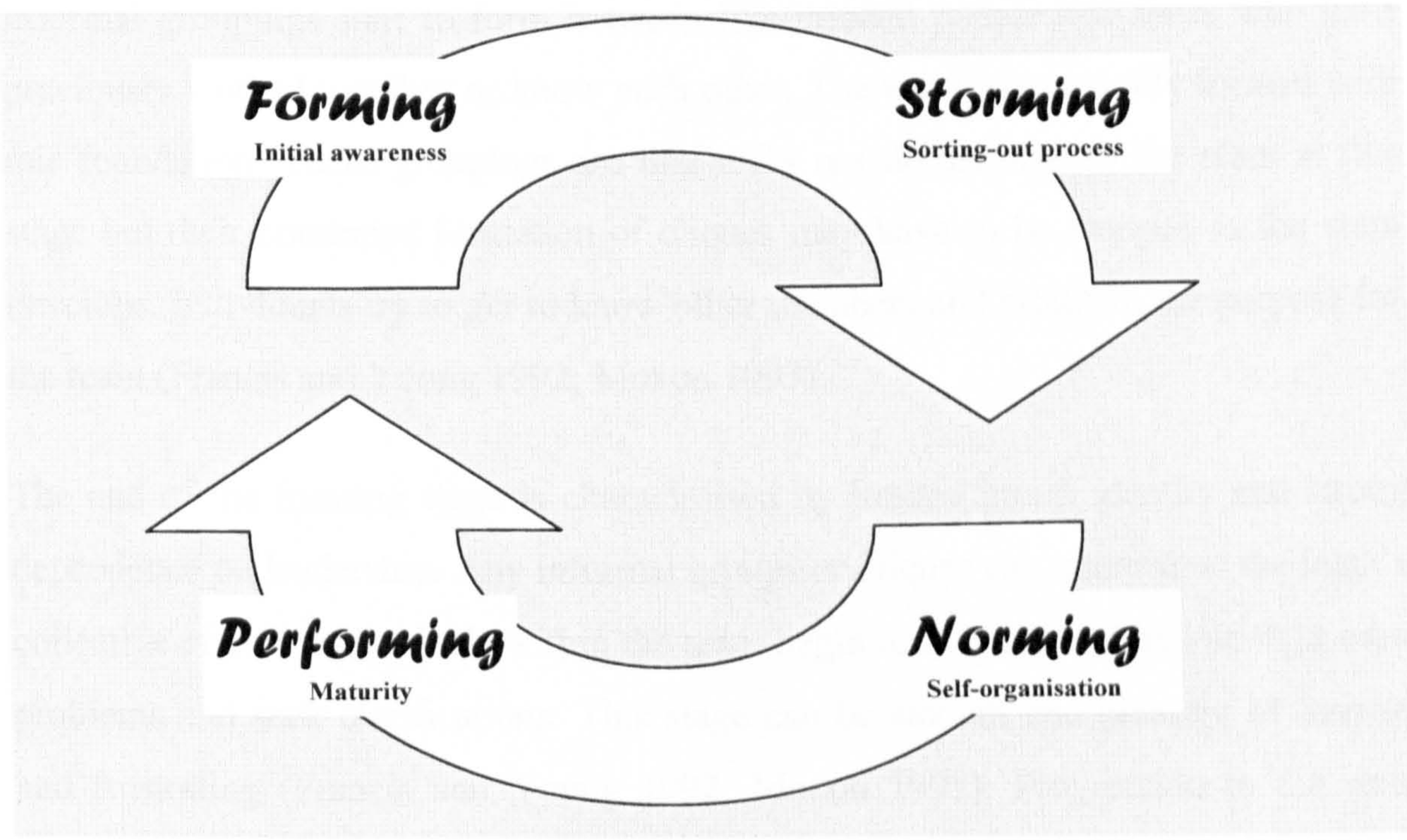

Figure 3.2 Tuckman's four-stage team development model

Source: Tuckman (1965)

Forming (Collection)

This is the initial awareness stage comprising a collection of people who do not know each other. All potential teams start as a collection of people and come together quickly or gather slowly depending on the task ahead. The key issue confronting the people is trying to find out why they are in the team (Hensey 2001; Lewis 1996). The leadership is often unknown and the objective is unclear to most of

them at this stage. The composition of the team is very dynamic at this stage as members move in and out. There is no firm team identity and members at this stage try to come to terms with new leadership or team members as the case may be (Moxon 1993).

True feelings are often withheld or kept to a minimum during feedback and people generally tend to be polite. The period can be a testing time for the members as they weigh their level of acceptance within the team. Ideas are kept simple and controversies are usually avoided. People normally say things that are acceptable and avoid serious issues so there is very little visible disagreement (Hensey 2001; Moxon 1993).

Informal groupings start to form between like-minded people and those who have previously worked together or know each other. The team is eventually formed with this foundation. These groupings are unusually not detrimental to the team at this stage but their continued formation of cliques may have to be stopped as the team develops. Individuals try to get to know other members and establish the purpose for the team (Francis and Young 1992; Moxon 1993).

The end of the forming stage is characterised by limited group identity and strong dependence on leadership. Any informal groups or cliques can undermine the team's collective efforts. Individuals within the team begin to manage and handle their own problems and seek clarifications. This stage can be smooth and pleasant or intense and frustrating (Francis and Young 1992; Moxon 1993). Progression to the next stage of development is often driven by the desire of the leader or a member of the team to progress. This requires the replacement of comfortable discussion with real sharing of feeling and the taking of risks even if it results in personal attacks by others (Moxon 1993).

Storming (Group)

The next stage of development starts when people begin to open up and become more transparent with each other. The group begins to develop identity, purpose and interest. Members begin to discover more about each other, such as values, skills,

interests and personalities (Hensey 2001). People begin to get used to each other and develop some understanding of its goals and purpose. This stage involves sorting out processes and bid for control and power. It is often marked with competition and conflict between individuals and sub-groups, which makes the stage the most difficult and also the most important for the team to work through (Lewis 1996; Rungapadiachy 2004).

The authority of leadership is questioned and there are doubts whether resources are sufficient to meet the demands of the task ahead. Decision-making processes and control mechanism are formulated at this stage, which are critical to the effectiveness of the team. Issues such as "who is in control" and "how it is exercised", dominate the group at this stage. Members are also interested in knowing what will happen to those who rebel within the group (Clark 2005; Francis and Young 1992). There is preparedness to sacrifice individual preferences for collaborative approach and members start to express their views strongly. Ideas of others are challenged and emotions are expressed to the fullest. Listening is poor and there is a high level of reacting or defending. Competition for control is high and that can make other members withdraw (Holpp 1999; Moxon 1993).

Informal grouping are used to gain support for idea and to influence and control the rest of the team. There is a wide range of behaviour and participation at this stage of the team's development. Attempts to resolve conflicts within can rise to higher levels. The output from the team at this stage is below expectation because they result from compromises (Brue and Launsby 2003; Clark 2005). Individual creativity is often rejected because they are viewed with suspicion as an attempt to dominate the team. It is very easy for the team to disintegrate at this stage and blame it on differences in personalities. Unresolved issues that undermine the strength of the team must be dealt with at this stage before any further progression to the next stage of development (Levi 2001; Moxon 1993).

Progression to the next development stage depends on whether members can overcome their unwillingness or inability to listen to and understand each other. They must avoid the tendency to react without basis, jumping to conclusions and

unnecessary attacking and defending. The possibility of sub-group dominance of the team must be avoided and differences must be allowed to be voiced out and resolved. The key to moving forward is for individuals to defend their own views and accept that their views could be wrong or there may be better views (Holpp 1999; Moxon 1993).

Norming (Developing team)

This is the stage where the emerging team is developing and has goals, roles and relationships. Control issues are resolved and members begin to tackle the task ahead with new energy. There is self-organisation within the developing team as it begins to sort out its problems together. Members begin to cooperate with each other and there is a distinct shift in the attitudes of members. Competition is replaced with collaboration and standards become established. Members get to know what is expected of each other and get an understanding of their mutual tasks (Francis and Young 1992; Hensey 2001; Lewis 1996; Moxon 1993).

The stage is characterised by active listening, shared leadership, systematic and methodical working approaches. Team members become more accommodating to other ideas and are prepared to change preconceived ones (Clark 2005; Levi 2001). There is active participation by all and conflicts are seen as mutual problems and are resolved collectively. There is self-disclosure by members who exchange ideas and communication is open and clear. The quality and speed of decision-making is improved at this stage of the team's development as members and groups become more receptive to each other's ideas (Hensey 2001; Moxon 1993).

There is increased interdependence from leadership and roles become more fluid. Strengths and weaknesses of team members are tolerated and there is increased readiness to compliment each other's efforts. The benefits of working together in a collaborative manner become very clear to the team. Levels of trust within the team increase as it moves into the last stage of development which requires unanimous agreement by all members. This is necessary for the attainment of a high level of trust needed to function effectively at the performing level of team development (Francis and Young 1992; Holpp 1999; Moxon 1993).

Performing (High-performing team)

At this stage, the team acts on common goals with synergy, high morale and productivity. This is the maturity stage where the team is fully functional and progress is seen (Tuckman and Jensen 1977). Members of the fully established team develop rapport and closeness. The team is totally focussed on the task ahead and individual skills are fully utilised to their best advantage. Members at this stage begin to experience intense loyalty to the team. It is seen as closed to those outside and introduction of new members at this stage is often difficult. This is because of the increased likelihood of the new member having values opposed to what has already been developed by the team (Francis and Young 1992; Hensey 2001; Lewis 1996).

The performing stage of team development is characterised by high creativity and flexibility in contributions from the members. Members are open, and trust for each other is high leading to the formation of strong relationships. There are feelings of warmth towards one another throughout the team and differences in view are easily accepted. Shifting of roles from one to another is easy and efforts are spontaneous and collaborative and members share all information that is relevant to the team and the task being undertaken (Hensey 2001; Holpp 1999; Moxon 1993).

The team becomes less dependent on structure and available resources are shared comprehensively. Individual opinions and preferences are acceptable and no longer considered as threats. There is a high sense of achievement within the team and success and failures are constantly reviewed for further improvements. The team is relaxed at this stage but continuously achieves more than what is expected (Clark 2005; Levi 2001; Rungapadiachy 2004).

Adjourning (Mourning)

This is the stage where the team disband, usually, following the successful completion of the task setting up for the team. Members of the team can move on to new assignments with a sense of fulfilment (Tuckman and Jensen 1977). This stage can also be reached due to failure to accomplish goals or because of unanticipated problems that make interactions within the team impossible. It can also signal the end of the involvement of certain individual members within the team

(Chrzanowska 2002; Clark 2005; Rungapadiachy 2004). The adjourning stage can be very stressful as members might be ending social relationships they have developed. There is a sense of loss, insecurity and anxiety from the change (Levi 2001). The stage is highly emotional and may be approach with excitement, relief or frustration by various team members. This can lead to a desire among members to avoid dealing with issues at the adjourning stage. Arguments over trivial issue may suddenly surface but some team members will focus on both the positive and negative experiences (Friday 2003; Levi 2001; Priest and Gass 2005).

Team members, at this stage, can enjoy being together and can look for reasons to justify their continued existence. However, if the team is kept together at the adjourning stage, the members become unproductive and can be caught in conflicts that they are unable to resolve. The feeling at this stage is for the team members to move on to new challenges (Clark 2005; Levi 2001; Webne-Behrman 1998).

Table 3.2 The five stages of team development

Soucres: Chrzanowska (2002) Levi (2001) and Tuckman and Jensen (1977)

Stage of development	Activity	Underlying processes	What you notice/what happens
Forming	Orientation: members getting to know each other	People feel separate, dependent, anxious and relatively powerless	Awkwardness, caution, light social chat and testing behaviours
Storming	Conflict: disagreement about roles and procedures	Share of voice, demanding attention, challenges to leadership, pecking order, opting out or rebelling	Leadership challenged, question task, emphasise individuality, dominant and passive emerge and physical disruption
Norming	Structure: establishment of rules and social relationships	Sense of harmony, cohesion and support, norms emerge, groups take off	People take turns in speaking and other listen, positive and more harmonious feel of energy
Performing	Work: focus on completing the task	Individual are subservient to the group, more flexible and task-oriented roles	Sense of concentration and flow, high energy and productivity, everything seem easy
Adjourning	Dissolution: completion of task and end of the team	Completion of assignment, disbanding of team and need for closure	Reluctance to break up, feeling of accomplishments, may be a sense of loss and anxiety

Relevance within the construction project environment

Construction project teams are expected to develop and perform at the highest level within a relatively short period. Members of the project team come together from various teams where they have established relationships and cultures (Cornick and Mather 1999). The natural development of the team through the various stages previously discussed may be curtailed or certain stages skipped. The challenge for teams within the project environment is to be able to complete all the relevant development stages to reach full maturity and perform at the highest level with a relatively short period of construction. The various stages of team development has influence on cooperation and synergy within the team and Vandeveer (2004) shows the relationship in Figure 3.3

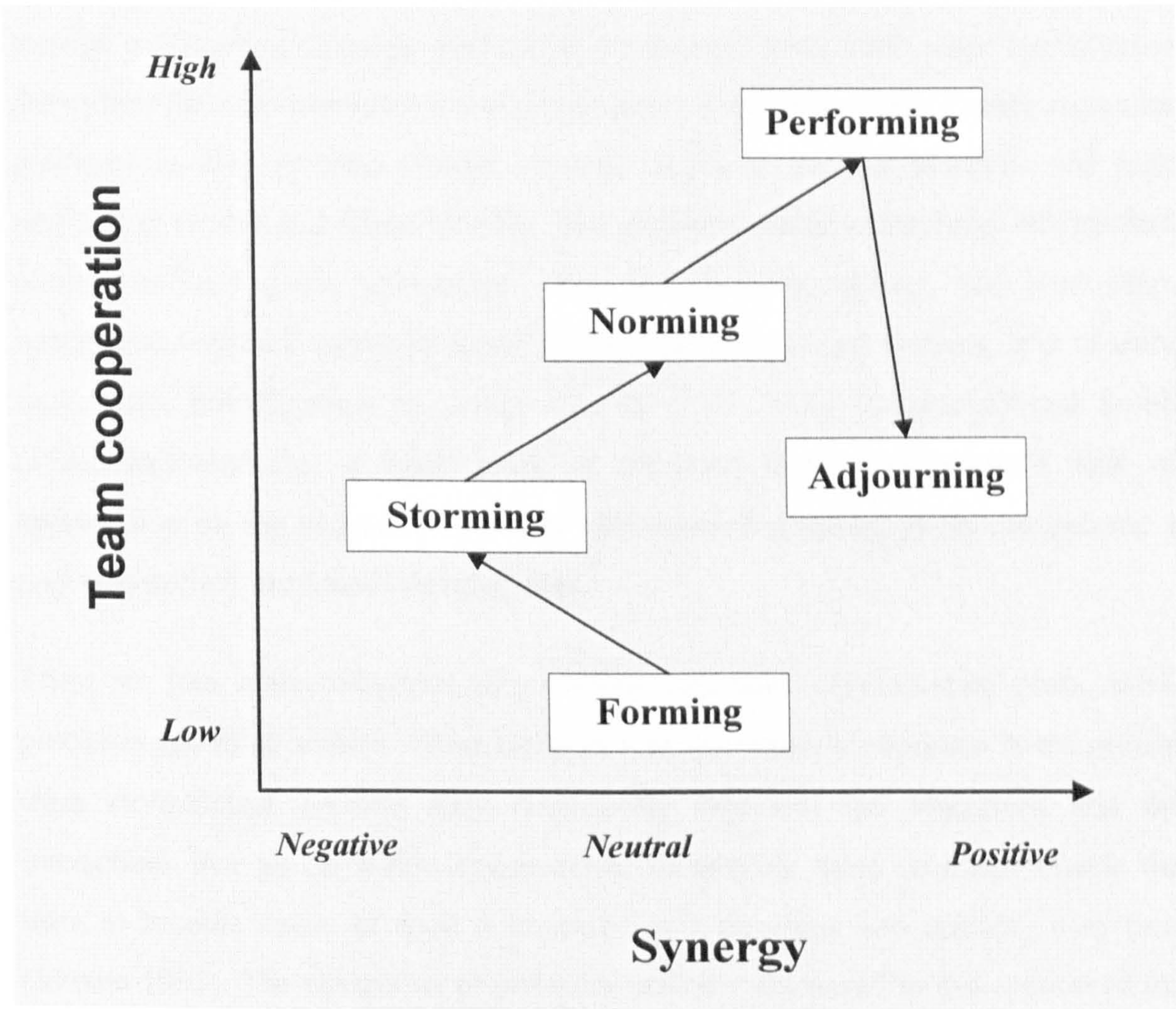

Figure 3.3 Five stage model: team cooperation and synergy

Source: Vandeveer (2004)

The forming stage, for example, can happen rapidly because teams are contractually brought together following successful bids. The storming and norming stages are completed based on how early relationships are formed, clear project goals are established and the extent to which members are willing to compromise. These depend on the type of contract, project complexity and expectations of the various team members and determine when the performing stage may be reached, which could be at an advanced stage of the project. Adjourning stage becomes an unavoidable stage of the team as construction project teams are formed for specific task and, therefore, disbanded when the task is completed.

3.3.3 PROBLEMS WITH TEAM DEVELOPMENT

As previously discussed in Section 3.2.1, teams do not mature instantly but go through a serious of stages to perform at the highest level. Each stage has inherent difficulties that the team must overcome to move to the next stage. Teams encounter problems as they develop through various stages to become effective and high performing (Conti and Kleiner 1997). The problems faced come from mismatched needs, confused goals, unresolved roles, bad decision-making, bad leadership, insufficient feedback and/or information, ill-conceived reward systems, lack of team trust and/or unwillingness to change (Castka *et al.* 2001). Katzenbach and Smith (1993) indicated that a weak sense of direction from management's lack of appreciation on the importance of clear definition of purpose, goals can become a major obstacle to the team's development.

There are four main categories of problems with team development; goals, roles, processes and relationships. These categories are particularly important to the project team environment because they collectively represent the objectives and the interactions that go on within construction. Identifying these problems enable the team to become aware of what is expected as it develops into maturity over time (Moxon 1993). The categories of problems are now discussed in this section of the thesis. The discussion highlights the importance of the category, potential issue that can become problematic for the team, when they can occur during the development of the team and how they can be overcome or reduced to a minimum.

Goals

The establishment of clear goals and purpose to which the team members will be committed is important for the team's development and performance (Katzenbach and Smith 1993). This can be a trying experience at the early development stages of the team where members challenge and argue with one another on how achievable the objectives of the team are. Problems of this nature can be overcome by members sharing their objectives with others to help them understand their personal situations and pressures (Moxon 1993).

Moxon (1993) submitted that a number of issues can occur with regards to the goals or objectives of the team. These are:

- the clarity of goals and how they are understood by the team members and whether they are specific and measurable;
- independence or inter-dependence of goals and whether they encourage joint or individual working; and
- how far the objectives of the team have been shared and the extent to which they create duplication or possible conflicts.

Establishing clear and committed project goals within a construction project is a challenging task. This is because various members of the team come together with their individual and often competing organisational goals and objectives (Bender and Septelka 2002; Chan et al. 2004). Aligning these individual goals with those of the project involves compromises and that can become a major problem during the team's development. This can eventually affect the level of cooperation and often, trust, within the project team because especially when each member of the team decides to protect his own interest (Cornick and Mather 1999; James and Walker 2002). The major challenge is for the project goal to be fully met without unduly sacrificing the interest of any particular member or group of members within the team.

Roles

Roles within a team are clarified only when the goals are established. Keeping sight of the goals and the consequent perceptions of roles also vary widely in existing teams. This is especially the case when a new member or leader joins the team with an expectation of his/her role. The problem is further compounded by the fact that expectations are not written with job description but heavily influence the judgements of members. Individualism is a big part of the problems and can blur the vision of the team. Early and ongoing sharing of expectations of members can prevent many of the problems that arise (Conti and Kleiner 1997; Moxon 1993).

Typical problems, according to Moxon (1993), relating to the roles within the team include:

- members understanding of role boundaries and their degree of freedom and authority;
- individual views of roles and how they match up with the expectation of others in the team; and
- confusion or conflicts that may arise from possible overlap of responsibilities.

Within the construction project environment, roles are often dictated by the procurement arrangement as previously discussed in Section 2.3. Members of the project team have very little influence on the formal roles assigned to them. The real problems surface when these roles do not match up with their expectations. Members become frustrated and that eventually affect their output within the team. Problems also arise when a particular role can be played by more than one member of the team. Responsibility for any failure that occurs becomes a major bone of contention as each member refuses to take the blame (Vandeveer 2004; Vincent and Kirkpatrick 1995). This is one area where "blame culture" has developed in the construction industry and presents a major challenge to team development.

Processes

Problems encountered by the team with regards to processes fall into three broad areas. These are decision-making, communication and meeting process and leadership style. Collective decision-making in a team can lead to the suppression creativity and individual input. On the other hand, a state of constant conflict within a team with many opposing views prevents collective decision-making. These concepts are opposite and yet both present a problem to the team (Conti and Kleiner 1997). Moxon (1993) highlighted the problems faced by the team in decision-making as:

- clarity of responsibility for decision-making;
- authority levels and veto rights;
- who needs to be consulted before decisions are made;
- the extent to which decisions need to be made by consensus;
- how decisions are made in the absence of any individual; and
- the way in which decisions are communicated.

Decision-making in construction is often complex due to the number of specialists with competing interests. The challenge faced within the construction project team is how to ensure that the various professional contributions have been fully incorporated in the final decision (Webne-Behrman 1998; Whybrow and Parker 2000). The team leadership has to ensure that all members are consulted for their expert opinions during the decision-making process. The project team members are also faced with the challenge of ensuring that the professional input is both requested and considered in decision-making.

Decisions made would have to be communicated clearly to other members of the team. Problems faced by the team with respect to communication and meeting processes are:

- what needs to be communicated to whom and within what time period;
- balancing provision of information with excessively loading people with data;
- the extent and individual tolerances for keeping people informed;
- structure, content and frequency of various team meetings;
- attendance at team meetings; and
- discipline of meeting process such as time keeping, preparation and keeping on track.

Communication is at the core of every team and this is the same within the construction project environment. The presence of different complementary functional skills means that each member of the team has to communicate the implications of his work to other members of the team. This places communication at the centre of the construction project team. A breakdown in communication implies that some members of the team will not be fully informed of the implications of the actions of others within the team (Hensey 2001; Rungapadiachy 2004).

Processes and procedures adopted by the team are both affected significantly by the leadership style and approach. Problems encountered by the team include:

- the way the leader chooses to operate and behave;
- the nature of the leader's position of authority; and
- the extent to which leadership is prepared to seek and accept feedback on both style and impact on the team.

Leadership of the construction team is dependent on the project team structure, which comes from the procurement arrangement and has changed with the introduction of different systems of project procurement as previously discussed in Section 2.3. The challenge of effective leadership of the project team within the construction environment is how leadership changes resulting from changes in

procurement system are carried through. The traditional leadership role of the Architect of the project team, for example, has changed over the years with the introduction of project management and other procurement approaches that places much emphasis on management (Ashworth 2002; Gould and Joyce 2000; Greenwood and Walker 2004). The behaviour and the authority of "new" leaders of the project team is constantly being challenged as these "new" leaders attempt to establish themselves and relate to other members of the team.

Relationships

Problems with relationships are usually deep seated and difficult to resolve especially at higher levels of management. They become powerful determinants of behaviour of team members towards each other (Moxon 1993). The problems may impose limitations on the growth potential of the team and include:

- the extent of mutual respect for one another within the team;
- understanding and respect for each other's needs; and
- the extent to which basic values and attitudes of team members fit together or conflict.

The hierarchical structure of the construction has influenced the perception and subsequent treatment of certain parties within the project team (Greenwood and Walker 2004; Harrison and Lock 2004; James and Walker 2002; Jefferies et al. 1999). Consultants, for example, have always been at the top of the structure with contractors at the bottom. Contractors have often been treated as non-professional members of the team, though their contribution on buildability is extremely strong and professional. The call for respect for all involved in the construction process is currently high on the agenda of the industry. This is because poor relationships within the industry is increasing fragmentation and consequently reducing productivity (Egan 2002; Egan 1998).

The discussion above have highlighted that construction project teams face problems during their transition to maturity The nature of the industry, procurement

arrangement, the presence of different professionals and traditions within the construction environment have all contributed to problems faced by the project team, especially during the delivery period of a construction project. Table 3.3 summaries the key problem issues faced by the project team throughout its development. These problems have to be overcome if the team is to be characterised and work as effectively and efficiently as discussed in next section of the thesis.

Table 3.3 Problems encountered during team development

Source: Moxon (1993)

Problem Category	Key issues
Goals	- Do people understand and accept the team's primary task? - What are the team's priority objectives and do all agree? - How are conflicts in priorities handled?
Roles	- What do the team members expect of each other? - Have these expectations been shared and do they match? - Do individual objectives fit the team's overall objectives? - Are there areas of overlap or duplication between team roles that could produce conflicts?
Processes	- How are decisions taken and are authority levels clear? - Are communication processes across the team working? - Are structures, content and processes in meetings effective? - How are problems and conflicts resolved? - How activities are coordinated and are reporting procedures understood and adhered to?
Relationships	- How do team members treat and feel about each other? - Are people's individual needs recognised and respected? - Does the team climate allow for open debate and sharing of concerns? - Do the team and leader encourage feedback on team and individual performances?

3.3.4 EFFECTIVE TEAM CHARACTERISTICS

Effectiveness is a notional outcome which measures the way in which resources are utilised. It is the degree of correspondence between actual and desired output. Effectiveness is the extent to which desired results are achieved (Ingram *et al.* 1997). It lies in the balance of production of desired results and production capacity. An effective team achieves what it is set out to achieve within its capabilities. What

characterises such a team is, therefore, an assessment of outcomes (output) based on inputs (Covey 1994).

Research on team effectiveness has received considerable attention and they have been devoted to finding a success formula. Conclusions from these studies indicate that an effective team must have the right combinations of roles in addition to the requisite skill and abilities to perform to their task (Belbin 2004). Other factors such as personality, attitudes and tasks processes and maintenance skills affect the effectiveness of the team's performance (Prichard and Stanton 1999).

A team is effective when it produces outstanding results and succeeds in the face of all difficulties. Such a team has worked through problems, has deepened relationships and clarified roles. Members are responsible for each other and their personal contributions toward the desired objective of the team (Harris and Harris 1996). An effective team results from painstaking effort through a skilful combination of appropriate talents and positive team spirit (Francis and Young 1992).

The characteristics of an effective team have been cited by many researchers (Belbin 2004; Francis and Young 1992; Harris and Harris 1996; Holpp 1999; Katzenbach and Smith 1993; Parker 1990; Smith 2000). These characteristics can, however, be put into five main categories of output, objectives, energy, structure and atmosphere.

Output

An effective team can deliver more than sum total of what the individuals could do in isolation. The team is able to make the right functional and team role combination of its members, who have diverse skills, to produce desired results. Members have the right attitude and perspective (Belbin 2004; Belbin 2003; Francis and Young 1992; Harris and Harris 1996; Smith 2000; Tarricone and Luca 2002).

Objectives

An effective team acts in terms of its purpose and goals to achieve its mission. There is thorough understanding, acceptance focus on the common objectives for undertaking the task throughout the team. The objectives, often drawn from the

team's mission, take the form of both broad team objectives and specific objectives for each member. The objectives are freely discussed and formulated in such a way that members of the team commit themselves to achieving them (Belbin 2004; Francis and Young 1992; Harris and Harris 1996; Smith 2000).

Energy

Members of an effective team gain strength from each other and collectively feel more potent. Members listen to each other so every idea is heard. They are also comfortable with disagreement and do not avoid conflicts. Reasons for conflicts are carefully examined and not suppressed and the team seeks to resolve them collectively. Criticisms exist but they are constructive and are aimed at removing obstacles that prevent the team from performing the task ahead. The team has the capacity for synergy, a group energy that can be developed and utilised and its power goes beyond the sum of its individual members (Belbin 2004; Francis and Young 1992; Harris and Harris 1996).

Structure

Effective team members create mechanisms for dealing with issues of control, leadership, procedures, organisation and roles. Each member takes responsibility for both individual and team work. The team is self-conscious about its own operations and often examines how well it is doing or what is interfering with its operations. Contributions from all members are utilised without confusion. An effective team is thus flexible, responsive, orderly and directed (Belbin 2004; Francis and Young 1992; Harris and Harris 1996; Parker 1990).

Atmosphere

The atmosphere within an effective team can be observed within a few minutes to be relaxed and comfortable. Members create a spirit and culture that is open and that allows everyone to be involved and interested. Creativity is promoted and members are able to demonstrate leadership qualities at any given time. The atmosphere supports confidence sharing, effective listening, problem solving and members are able to take reasonable risks. Team success or failure is shared by all and members are able to do what is necessary to serve the interest of the team. This results in an

environment where each member of the team is comfortable with the other and there is total cohesion throughout the team (Belbin 2004; Francis and Young 1992; Harris and Harris 1996; Parker 1990; Tarricone and Luca 2002).

Challenge for effective construction team

The characteristics of an effective team discussed above present a major challenge for team in project-based sectors. The continued criticism of the performance of the construction industry as highlighted by reports discussed in Section 2.5 means that teams are still not effective. This is because the output of an effective team is expected to be very high. The period within which project teams come together and disband also presents a major challenge. Establishing a common objective throughout the team to generate enough group energy within such a period is difficult. The same difficulty confronts the project team in the creation of effective mechanisms for dealing with structures. Total cohesive is often associated with teams that have been together over a period of time which is longer that what construction project team gets. The project team consequently, struggles with issues of common culture and team spirit. The role of leadership consequently becomes crucial in driving the team towards the goal for which it was set up to achieve.

3.3.5 CONSTRUCTION TEAM LEADERSHIP

Leadership as a concept, especially in teams within organisations, continue to receive much attention in research. Many definitions and theories exist on both team and organisation leadership (Cobb 2006; Daft 1999; Horner 1997; Kogler-Hill 2004; Kolb 1995; Nothouse 2004; Richards and Moger 200; Sheard and Kakabadse 2002; Yukl 2005; Zaccaro and Banks 2001; Zaccaro and Klimoski 2001).This section focuses briefly on the role leadership in the effectiveness of the construction team. The discussion is within the context of construction project delivery team leadership which has evolved over the years with changing procurement systems (discussed in Section 2.3).

Leadership has consistently been related to the effectiveness of an organisational group or work team (Daft 1999; Kogler-Hill 2004; Richards and Moger 200; Yukl 2005). This is because leadership ensures that the vision and strategy that are

required to align the culture and values of the organisation are communicated effectively to all members. It focuses on people rather than processes to create changes that are required for progress. Team leadership involves using the team's characteristics and processes to ensure effectiveness. The leadership must, therefore, understand the dynamics of the team such as the development stages, cohesiveness and conflict (Daft 1999; Nothouse 2004; Sheard and Kakabadse 2002).

The nature and composition of the construction team makes the issue of leadership very important. This is because of the number of different functional units with unique identities that come together during the construction period to assume a new identity. Effective leadership of the construction team is required to ensure that the various functional units complement each other to deliver the project. Leadership is consequently at the core of the concept of teamwork within the project delivery team. The next section, 3.4, discussed the concept of teamwork, which is important for improved project delivery performance to acceptable levels.

3.4 THE CONCEPT OF TEAMWORK

The definitions of team in Section 3.2.1 and further review of literature of teams in Section 3.2 of this thesis indicate that effective teams comprise people with skills that are complementary. There is also a balance in the function and team roles within such a team (Belbin 2003; Francis and Young 1992; McCrimmon 1995; Tarricone and Luca 2002). These are necessary for the team to achieve the goals for which it was set up for.

Bringing people together does not ensure that they will work together efficiently and make the right decision. However, teamwork is already in place when two or more people have to share information and make a decision (Samuel 1996). The definition of teamwork in Section 3.2.2 of the thesis also emphasises on the need for team members' efforts to be coordinated in a co-operative manner toward the achievement of a common objective (Conti and Kleiner 1997; Dickinson and McIntyre 1997; Scarnati 2001). Teamwork concept, therefore, goes with the inception of a team and is either effective or ineffective (Samuel 1996).

The concept of teamwork, though not new, has always not been easy to grasp. The existence of teamwork concept is often taken for granted because it is assumed to be the core concept of team formation (Harris and Harris 1996; Hayes 2002; Samuel 1996; Scarnati 2001). This attitude has affected the effectiveness of the concept, especially in multidisciplinary environments such as construction, where activities are carried out by people with different skills within and across organisations who must share knowledge for optimum decisions (Baker and Salas 1997; Guzzo and Dickson 1996; Steward and Barrick 2000).

3.4.1 TEAMWORK PROCESSES

The introduction of teamwork has two objectives; co-ordinating and innovating. It is one measure to open horizontal communication to improve the flexibility of the organisation. It is, however, not a panacea for solving all coordinating problems and poor application can affect individual responsibility and decision rights. The usefulness of teamwork lies in its proper application (Nurmi 1996). Dickinson et al. (1992) identified and defined seven key components of teamwork process which are critical to any improvement exercise. The components of teamwork process and their relationships are diagrammatically presented in Figure 3.4.

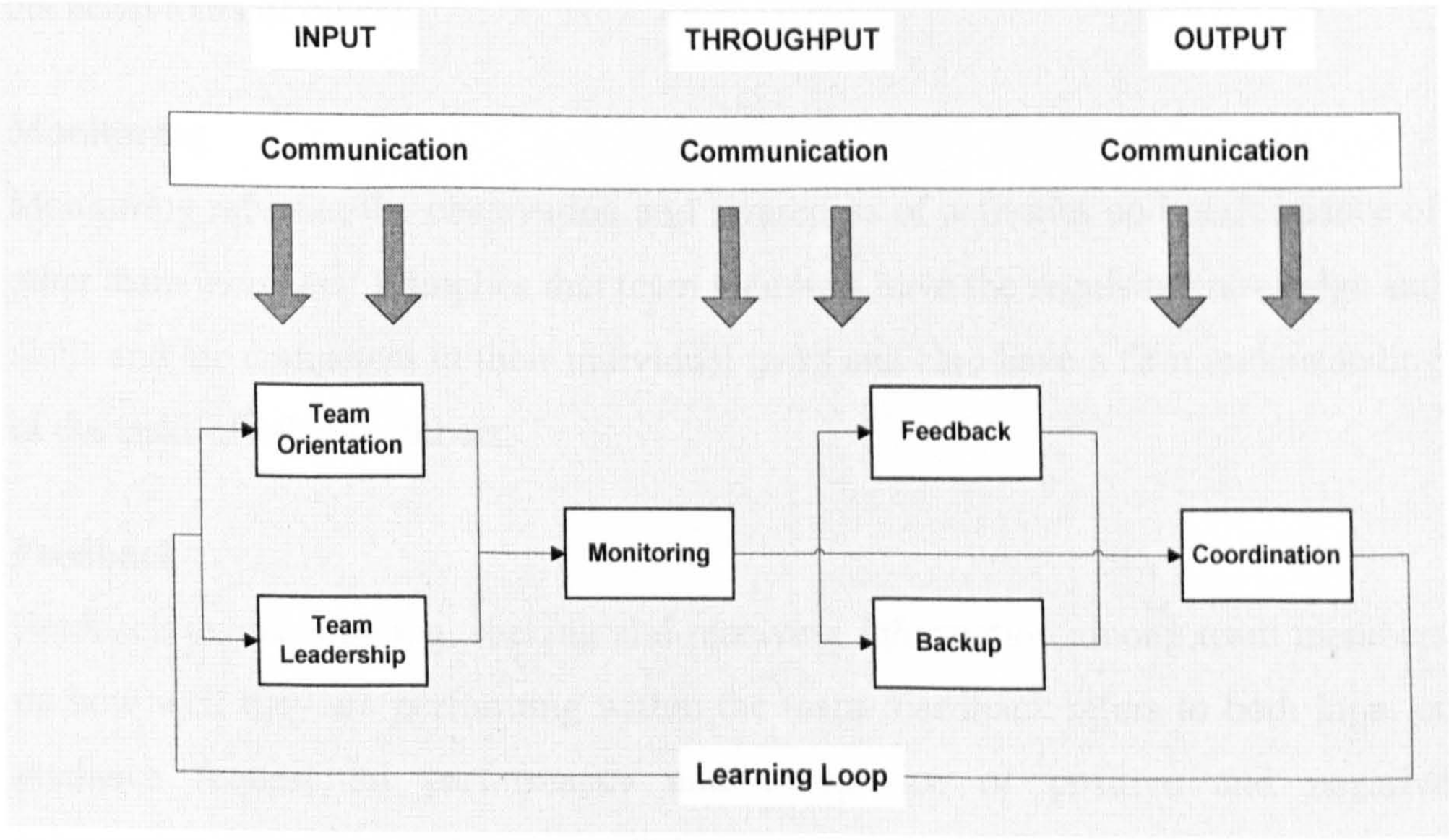

Figure 3.4 Teamwork Model

Source: Dickinson and McIntyre (1997)

Communication

This is a major component of the process and involves the active exchange of information between two or more members of the team. It includes the provision of information by an individual team member to another in a prescribed manner using appropriate terminology. It is used to clarify or acknowledge receipt of information. Communication is a mechanism that links the other components of teamwork such as monitoring other member's performance and feedback provision about that performance.

Team orientation

Team orientation is the nature of team member attitudes towards one another, the team task and leadership. It reflects acceptance of team norms, level of group cohesiveness and importance of team membership.

Team leadership

This component involves the provision of direction and by the team leaders and other members. It does not necessarily refer to a single individual with formal authority over others but it can also show leadership by several team members. It implies that planning and organising activities have enabled members to respond as a function of the behaviours of others.

Monitoring

Monitoring refers to the observation and awareness of activities and performance of other team members. It implies that team members have the requisite knowledge and skills and are competent in their individual tasks and also have a firm understanding of the tasks of other members.

Feedback

Feedback involves giving, seeking and receiving information among team members on how well they are performing within the team. Feedback refers to both input or guidance request on performance and acceptance of positive and negative information regarding performance. It is necessary for improvement with regards to how the team members adapt to one another and the team as a whole.

Backup behaviour

This component deals with the behaviour of the team members in helping other members to perform their tasks. The presence of backup behaviour in a team implies a degree of member flexibility and the willingness to provide and seek assistance.

Co-ordination

Co-ordination reflects the execution of the team activities such that members respond as a function of the behaviour of others. The successful execution of this component implies that other components of the teamwork process are in effective operation. This is the only way to ensure that the actions of individual members are merged to produce a synchronised team performance.

Challenges within the construction project environment

The various processes outlined above highlight some challenges for the construction project team. Communication is, central to the efficient performance of the project team because of the different skills requirement of construction projects. The challenge is to ensure that the right information gets to the appropriate person without compromising the competitiveness and/or confidentiality of your own organisation. Other challenges within the construction project team environment in relation to teamwork process include:

- ensuring that attitudes from their previous teams which conflict with that of the project team are properly aligned;

- achieving acceptance rather than compliance from members to share a common vision with leadership, which is often imposed by the terms of the contract, especially at the early stages of the project;

- getting all project team members to be aware of other performances and correcting members when they go wrong especially in an environment where everything is covered by a contract; and

- ensuring that members suggest better ways of undertaking even when there is no direct benefit to the individual member but to the team;

Table 3.4 summarises the definitions and examples of the various components of teamwork process

Table 3.4 Definitions and example statements of teamwork process components

Source: Dickinson and McIntyre (1997)

Component	Definition	Example statement
Communication	Exchange of information between two or more members of a team in the prescribed manner using acceptable terminology	- verifies information prior to making a report; - acknowledges and repeats messages to ensure understanding.
Team orientation	Attitudes of team members towards one another, which reflects team norms, level of cohesiveness and importance of team membership	- assigns high priority to team goals; - willingly participates in all relevant aspects of the team.
Team leadership	Provision of direction, structure and support for other members of the team by team leader or other members of the team	- explains to other team members exactly what is needed from them during an assignment; - listens to the concerns of other team members.
Monitoring	Observation of activities and performance by other team members where all members are individually competent and can provide feedback and backup behaviour	- is aware of other members' performance; - recognises when a team member performs correctly.
Feedback	The provision of information regarding other team members' performance either by requesting input or guidance or accepting positive or negative information.	- responds to other members' requests for performance information; - accepts time-saving suggestions offered by other team members.
Backup behaviour	Assistance with the performance of other team members' by those who have an understanding of their roles and the willingness to provide and seek help when needed.	- fills in for another member who is unable to perform a task; - helps another member correct a mistake.
Co-ordination	The timely execution of team members' activities in an integrated manner and the exchange of information that influence another member's performance.	- passes performance-relevant data to other members efficiently; - facilitates the performance of other members' tasks.

3.4.2 BENEFITS OF TEAMWORK

Teamwork within organisations has resulted in increased efficiency and productivity. However, careful planning and appropriate use of tools and techniques are required to pave the way for enhanced teamworking (Conti and Kleiner 1997). Teamwork is a critical component of many organisational change efforts. Consequently, corporate objectives can effectively be pursued through teamwork but success must be supported by changes in cultures, structures and systems (Scarnati 2001).

Successful teamwork is beneficial to both the organisation and the individual members who work within the team (Rabey 2003; Tarricone and Luca 2002). These benefits occur through efforts and planning by top management who shape the organisational setting in which teams are given the freedom, resources and support to undertake tasks (Ingram *et al.* 1997).Tarricone and Luca (2002) and Rabey (2003) concluded that teamwork can produce for the organisation:

- an assurance of on-time quality performance improvement;
- maintenance of the organisational culture and values;
- minimise and reduce costs and number of employees;
- increase profits and reduce the hierarchical structure of the organisation;
- produce a motivated and committed workforce; and
- improve the process for the recognitions of team contribution.

Rabey (2003) further indicated that teamwork benefits the individual member by providing:

- congenial co-workers in a co-operative environment;
- opportunity to gain shared knowledge and skills; and
- the feeling of participation in a community of purpose.

3.4.3 ORGANISATIONAL BARRIERS TO TEAMWORK

Inspite of the benefits that teamwork bring to organisations, there are a number of factors that do not support the concept. These factors affect productivity, corporate culture and profitability of the organisation. There are six main factors within an organisation that can be potential barriers to teamwork (Conti and Kleiner 1997; Ingram et al. 1997; Rabey 2003; Scarnati 2001). These are as follows:

Structure

Structures within organisations are often geared towards individual rather than team effort. These structures, such as performance incentives, merit pay, management by incentives, end up creating a competitive team environment. Team members then switch into "win-lose" attitudes which is contrary to the "win-win" concept of teamwork.

Ineffective communication

Clear communication of desired outcomes is necessary to prevent team members from drifting aimlessly and eventually becoming discouraged. Clearly stated goals are essential to the organisation but they are unable to focus the team and provide the right guidance and direction when they are ineffectively communicated.

Lack of resources

The assignment and subsequent executions of tasks go with the supply of the right quality and amount of resources. Resources such as time, money, materials, moral support are all necessary and their absence has a negative impact on teamwork.

Lack of trust

Successful teamwork hinges on cooperation which is developed through trust and honest. Teamwork itself has been defined as a synergetic process that requires a high level of cohesion among team members. A lack of trust, therefore, undermines the collective efforts necessary for teamworking.

Corporate culture

A paradigm shift is needed from both management and workforce if teamwork is to be meaningful and effective. Employees' perception of teamwork being forced from top management would have to be replaced with belief that corporate values are congruent with their team-building rhetoric. Teamwork must not be overlooked but given a high priority and be promoted especially by management throughout the organisation.

Inappropriate use of team approach

Successful decision-making, an outcome of good teamwork can be time dependent and team approach may not always be the best. Sensitive decisions, for example, must be made unilaterally. Other situations call for leadership to be directive and tell other members what to do. Teamwork is effective especially for long term planning and the creation of team process that denies the organisation's ability to make rapid and timely decision must be avoided.

3.4.4 TEAMWORK EFFECTIVENESS

At the core of teamwork concept is a synergetic process that relies on all team members to contribute and nurture a positive team environment. This calls for the flexibility of team members to adapt to working in a cooperative atmosphere where goals are achieved collaboratively rather than through competition (Tarricone and Luca 2002). Ingram *et al* (1997) submitted that effective teamwork is characterised by:

- input factors such as group configuration and climate which are controlled and filtered by management;
- throughputs comprising activities and task such as team processes, cohesion, communication, decision-making, task activities, which enable the team to manage itself effectively, and maintenance activities of monitoring and reviewing internal forces and conflicts; and
- satisfactory organisational and individual outputs in comparison with pre-

determined criteria. Individually, there are tangible outputs such as rewards and recognition. Intangible outputs include courage to accept blame and learn from mistakes, which encourages the experimentation and new ideas.

Macaulay and Cook (1995) found out that effective teamwork is as a result of careful management and application to develop and maintain the team's commitment, focus and strength. They further indicated that effective teamwork gives an organisation a distinctive edge and is recognised by:

- support for one another and cohesion inside the group which provide a seamless service on the outside;
- lively, positive and friendly atmosphere where morale and energy are high people are open with one another;
- readily forthcoming new ideas which are well received within the team;
- willing and free sharing and availability of information;
- thorough knowledge of each other's responsibilities and performance;
- individual ownership and responsibility for tasks; and
- positive environment where personal development and contributions are recognised.

Literature on teamwork (Dickinson et al. 1992; Dickinson and McIntyre 1997; Drew and Coulin-Thomas 1996; Fisher et al. 1996; Golestani and van Zwanenberg 1996; Ingram et al. 1997; Larson and LaFasto 1989; Macaulay and Cook 1995; Nurmi 1996; Parker 1990; Smith 2000; Tarricone and Luca 2002) continues to increase. A recent addition is a self assessment matrix developed by Constructing Excellence (2004a). The matrix, shown in Table 3.5, identifies six key elements for effective teamwork; team identity, shared vision, communication, collaboration and participation, issue negotiation and resolution and reflection and self-assessment.

Table 3.5 Effective teamwork assessment matrix

Source: Constructing excellence (2004) adapted from Eclipse Research Consultants (2003)

		Key elements of effective teamwork					
		Team identity	**Shared Vision**	**Communication**	**Collaboration and participation**	**Issue negotiation and resolution**	**Reflection and self-assessment**
Progress towards best practice	**Level 4**	The team takes ownership of the problem and accept joint responsibility for its achievement.	The team has a shared vision and set of objectives, developed collaboratively and reviewed regularly.	Team members actively and openly share their knowledge and ideas around the whole team.	Familiarity, honesty, mutual trust and full participation harness the collective expertise of the team.	Divergent views are welcomed as a source of energy and a spur to the team's creative problem-solving.	The team regularly review members' roles and their impact on the team and acts on the outcome.
	Level 3	The team recognises that its members have individual and team goals and tasks are framed accordingly.	The team has developed for itself both a shared vision and clear objectives.	Team members communicate information and knowledge around the team.	All members are given opportunity to contribute and build on suggestions from others.	Sources of disagreement are addressed openly and resolved head-on through constructive negotiation.	The effect on the team of each member's different roles and responsibilities is clearly recognised and discussed.
	Level 2	The focus of team is on the task that individual members need to solve.	The whole team is working to a set of common objectives.	Team members communicate information when others need it.	The team seeks ideas, proposals and solutions from all its members.	Team members are prepared to explain their underlying assumptions and negotiate options.	Different roles and responsibilities are discussed from time to time.
	Level 1	Team members take limited interest in issues that lie outside their own immediate area of responsibility.	Members of the team are clear about their objectives but the team has no shared vision.	Individuals are protective of their own information and share reluctantly in response to specific request.	Team members prefer to work to alone and give more priority to their own concern than to those of the team.	Contentious issues are skated over or avoided completely; conflict is dealt with only superficially.	The team acknowledges its members have several roles and responsibilities but they are not reviewed.
	Level 0	Team members concern themselves only with their own responsibilities.	Team members, both individually and collectively, lack a common vision and clear objectives.	Information is passed to team members strictly on a 'need to know' basis.	Insularity, lack of trust or power struggles reduces participation and collaboration.	Conflicting opinions remain unaddressed and consequently slow progress.	The team places no value on considering and negotiating how they work together.

The matrix enables teams to assess themselves against best practice in teamworking. It comprises key aspects of effective teamwork and level of progress towards best practice. It is self-reflective and calls for periodic, rather than frequent reflection on the process of teamwork for effectiveness.

The matrix is particularly useful in benchmarking both the effectiveness and extent of teamwork. The clear identification of practices that is indicative of the level of progress within each key element also makes it easier to transpose it on a team. The matrix is used in this thesis in Chapter Four in determining the influence of team integration on the effectiveness of teamwork.

3.5 INTEGRATION WITHIN CONSTRUCTION

The construction industry is characterised by the presence of organisations, individuals, and groups of individuals with different but complementary skills and expertise needed for the delivery of a project. These multi-disciplinary groups or organisations must be coordinated to ensure that their individual inputs at various stages of the project execution proceed in an orderly schedule (Cornick and Mather 1999; Harris and Harris 1996; Howell 1996). Within the construction project delivery environment, information has to be shared across the organisations involved for optimum decisions. Teamwork, therefore, becomes a prerequisite rather than an option for the successful delivery of a project (Harris and Harris 1996; Samuel 1996).

Moore and Dainty (1999) further described construction as a collective activity and the construction industry a "team" industry. They indicated that successful project delivery and the performance of the construction industry depend, to a large extent, on how the knowledge and experience of many people can be pooled together. However, this is not an easy task given that most construction projects:

1. are completed over relatively short periods of time:

2. involve large numbers of organizations, teams and individuals who may not have previously worked together but need to be well integrated; and

3. draw upon considerable diversity in skills, knowledge and expertise.

The continued existence of confrontational attitudes and individual approach to work instead of cooperation and collaboration has adversely affected teamwork within the project delivery environment of the construction industry. The industry is looking for ways to bring the various groups together so that they work as a single multi-disciplinary and multi-functional group rather than a number of disjointed individual groups (Alshawi and Faraj 2002; Faniran et al. 2001; Moore and Dainty 2001; Payne et al. 2003). Research also indicates that teams are immensely beneficial when used in organisations. The basic underlining principle of team concept is to bring together, various complementary roles and the concept of integration is required to merge different disciplines into one single group. This section of the thesis reviews the need for integration, benefits, approaches, barriers and dimensions of effective integration of the project delivery team.

3.5.1 THE NEED FOR TEAM INTEGRATION

Team integration should be an aspiration because it leads to efficiency of the delivery process and cost effectiveness through elimination of waste. Profitability is increased and consequently competitiveness that enables firms to deliver value for money to clients' satisfaction. In the long-term, integration leads to survival as a result of increased ability to deliver value for money and better returns on investments in a competitive environment (Alshawi and Faraj 2002; Crane 2002; Lennard et al. 2002). Industry examples have reported significant progress achieved through integration (Strategic Forum for Construction 2003; Vyse 2001).

Efficiency of the delivery process

Egan (1998) highlighted that, the most successful enterprises do not fragment their operations and integration is needed for improved performance in the construction industry. Betts *et al* (1995) found out that, there are two basic activities of conversion and flow in any production system and both incur cost and time. Value is, however, added in conversion whilst flow activities such as inspection, waiting and moving add no value to the product. They highlighted that integration improves the conversion process and at the same time reduces or eliminates non-value- adding

flow activities. Anumba *et al.* (2002) concluded that a more efficient system is where both activities are simultaneously undertaken removing segregation and isolation to shorten the overall product delivery process. Potential wastes from design errors are then reduced or eliminated. The process time is subsequently improved from getting it right the first time.

Cost effectiveness

Many researchers (Akintoye 1994; Anumba et al. 2002; Opfer et al. 2002; Stutz 2000) have concluded that one of the reasons assigned to the popularity of integrated procurement approaches is greater price certainty. This, according to Ling and Khee (2000) and Ndekugri and Turner (1994) are achievable because, the method provided gives rise to fewer disputes and consequently future cost additions mainly from variations. Project costs are also managed more effectively in an integrated environment. It can also be argued that duplication of work and errors resulting from decision made without due consultation will lead to increased cost. In an integrated product delivery environment, all the necessary components of the process are able to contribute, leading to waste reduction, cost certainly and efficiency.

Long-term survival

The present state of the construction industry calls for the continued delivery of a satisfactory product to clients by an integrated team. This is critical for the future survival of a company and the industry as a whole (Egan 2002). Crane (2002), making a business case for integrating the team, pointed out that business organisations aim to achieve adequate returns on their investments and that can be achieved through the better use of scarce human resources through integrating the team. He further submitted that the cost of procurement of contracts amounts to 4.5 per cent of turnover for large companies, but it has been proven that integrating the team can reduce this cost by 30 per cent. Companies can consequently increase margins and make better profits. Team integration can consequently be seen as a significant approach in ensuring the long-term survival of not only the firms that embrace the concept but the industry as a whole.

3.5.2 INTEGRATION APPROACHES

The construction industry has approached integration from two main perspectives, namely project procurement and product delivery. An integrated procurement system, reducing the number of parties the client has to deal with, to a single responsible party has been adopted. The product delivery process has also been integrated to reduce the number of distinctive parties to a single all-inclusive party. The several separate and phased processes involved have also been merged into system capable of delivering the same product in a single process.

3.5.2.1 Procurement

Teams in construction have traditionally been formed along professional and functional lines and have unfortunately remained separate thus making the "team" industry a "teams" industry. The introduction of integrated forms of procurement such as Design and Build and other variants, previously discussed in Section 2.3, have not been able to fully merge the teams into one multi-professional and functional team. Attempts to introduce integration techniques from other industry have also achieved limited success (Ngowi 2000).

A review of procurement systems in Section 2.3 of this thesis indicate that the construction industry in the UK has moved, over the years, from separated to more integrated procurement approaches. The number of teams that clients deal with have, therefore, continued to reduce as these new systems of procurement encourage the formation of single multi-disciplinary and multifunctional delivery teams.

3.5.2.2 Product delivery

The product delivery process has been addressed from the "hard" or process and "soft" or people perspectives. Concurrent engineering, information and computer technology (ICT) and process models have considerably been used as techniques and tools to integrate the process of product delivery. Much of the issues relating to people have also been addressed through client leadership and transparency proposals, creation of project culture and institutional training of professionals.

Process

Concurrent engineering, a manufacturing industry technique, has largely been used as an approach to overcoming the fragmented nature of the design and construction team (Anumba *et al.* 2002; Evbuomwan and Anumba 1998; Jaafari and Manivong 1999; Love and Gunasekaran 1998; Ngowi 2000). The concentration has, however, been on how processes within the design and construction activities can be integrated (Love and Gunasekaran 1998). The use of information technology (IT) has focussed on improving communication among project participants with the view of increasing the level of information flow and share (Faniran *et al.* 2001). The real anticipated benefits have not been fully achieved as they have ended up in automating processes (Love and Gunasekaran 1998).

Client leadership

Roles that individuals can play or offer in a team environment have been researched but only in the context of existing process integration approaches. Greater client leadership has been found to successfully drive the process of inter-company integration that leads to the insistence on transparency and mutually beneficial processes for all parties (Dainty *et al.* 2001). However, there are still various professional disciplines in the integrated project delivery environment, each with its own cultural biasness which are often competing and make team interaction complicated and ineffective. The creation of single-focussed project culture has consequently been suggested by Moore and Dainty (1999) as a way of bringing the various professionals together. They further concluded that project member consistency, physical proximity of project team members and early involvement of team players can help break down these cultural barriers.

People issues

Moore and Dainty (2001) found that people issues in the integrated team could be addressed by conducting short-term team-building exercises to encourage mutual respect for the skills of other team members. Working in an integrated manner by the various professions could be started at the institutional level and that could lead to a compromise in forming new integrated professional bodies. Joint accreditation of

programmes by the various professional bodies can also be implemented to present the interdependent nature of the construction industry.

3.5.3 BARRIERS TO INTEGRATION

Integration for effective team performance can face barriers from sources such as the organisation, the leadership, or the team members themselves. Other typical barriers are lack of clear vision and resources by an organisation, unwillingness to take risk, information and leadership sharing. Failure of team members to provide feedback, work with minimum supervision and indifference in opinions can also affect team performance (Myers 1999; Nichol 2000).

Recent calls for change in general and integration in particular buttress the fact that there are still barriers that have prevented teams from working as a unit as expected or envisaged. Teams within the construction industry are still fragmented and unable to derive the full claimed benefits of integration (Egan 2002; Lennard *et al.* 2002; Payne *et al.* 2003; Strategic Forum for Construction 2003).

Organisation

Historically, the project delivery system has been a fragmented process and the nature of construction projects relationship has traditionally been contractual and adversarial (Alshawi and Faraj 2002; Lennard et al. 2002; Payne et al. 2003). Firms in pursuit of profit due to their independent nature have often ended up with adversarial attitudes. This has led to an inherent degree of mistrust and scepticism (Dainty *et al.* 2001; Ngowi 2000).

Contractual packaging of works has traditionally been according to trade or discipline. The parties do not need to know each other in order to participate in a project and this has resulted in less concern for interdependence (Ngowi 2000). Positions within the hierarchical structure of traditional construction process relationships, which are inequitable, have also resulted in high degree of inter-organisational conflict. Good working relationships have also been sacrificed for traditional adversarial professional boundaries (Moore and Dainty 1999).

Anumba *et al* (2002) also submitted that there is widespread resistance to the use or application of ICT, designed to specifically support organisational structure and decision making in a concurrent engineering environment. This is further worsened by the intense competition and the project driven nature of the industry that make organisations reluctant to invest in IT with no immediate and often guaranteed benefits.

Team members

The presence of diverse functional teams in a complex team interaction results in competing cultures. Project objectives are often aligned with these cultures making a single focused objective very difficult to attain. There is a work-group emphasis on reactive problem solving rather than initiative-taking problem avoidance (Moore and Dainty 1999). Teams also exist with same the main project goals but with different sub-goals. The alignment of these sub-goals usually present a challenge that has to be overcome by the team members (Love and Gunasekaran 1998).

Professional, communicative and attitudinal interfaces have also impeded the flow of information in an integrated team environment (Moore and Dainty 1999). Current practices allow only a fraction of the project participants to make decision, which has profound impacts on the entire project. Availability and free sharing of information among project delivery team members is limited throughout the project delivery process. (Jaafari and Manivong 1999).

Leadership

Roles and responsibilities within the construction project team environment continue to be under traditional fragmented system along professional lines (Egan 2002; White 2002). Though these were not detrimental in themselves, it led to discontinuities and ineffective responses to changes in the delivery process. Strategic professional alliances are formed and bounded by professional and cultural barriers resulting in work groups of individuals (Moore and Dainty 2001).

3.5.4 INTEGRATION OF THE PROJECT DELIVERY TEAM

Integrated approaches demand that individuals from various organisations work together to achieve common attainable project goals through the sharing of information. This means that different company processes and organisational cultures have to be aligned in a collaborative manner. Integration is often recognised as a continuous process with the objective of improving team culture and professional attitudes (Dainty *et al.* 2001; Howell 1996).

A project delivery team comprises those who are pivotal and involved in providing solutions that will meet the client's requirements in the delivery process. The team requires members to harness the potential of the processes associated with delivery efficiency (Egan 2002). The integration of the team requires a spirit of cooperation to overcome traditional adversarial attitudes and barriers discussed in Section 3.5.3 of this thesis. The members must also cross traditional departmental or professional boundaries to share their ideas while negotiating conflict at work. The team also requires a competent leader with the ability to drive the overall optimum achievement of initial team goals (Chen and Lin 2002).

Integration is used in construction to describe the introduction of working practices, methods and behaviours that create a culture of efficient and effective collaboration by individuals and organisations (Lennard *et al.* 2002; Strategic Forum for Construction 2003; Vyse 2001). Integration promotes a working environment where information is freely exchanged between the different participants. An integrated delivery team is a highly effective and efficient collaborative team responsible for the design and construction of a project. The team brings together various skills and knowledge, and removes the traditional barriers between those with responsibility for design and construction in a way which improves the effective and efficient delivery of the project (Achieving Excellence in Construction 2003; Akintoye 1994; Fleming and Koppelman 1996).

Past research (Anumba et al. 2002; Baiden et al. 2003; Bromley et al. 2003; Cornick and Mather 1999; Dainty et al. 2001; Evbuomwan and Anumba 1998; Love and Gunasekaran 1998; Moore and Dainty 1999; Strategic Forum for Construction 2003;

Vyse 2001) has identified six main dimensions that describe a team that has been fully integrated. Following on from these findings, the delivery team in a construction project can be described as 'fully integrated' when it:

- has a single focus and objectives for the project (Anumba et al. 2002; Baiden et al. 2003; Cornick and Mather 1999; Moore and Dainty 1999; Strategic Forum for Construction 2003; Vyse 2001);
- operates without boundaries among the various organization members and work towards mutually beneficial outcomes (Baiden et al. 2003; Bromley et al. 2003; Love and Gunasekaran 1998; Moore and Dainty 1999; Strategic Forum for Construction 2003; Vyse 2001);
- shares information freely among its members such that access is not restricted to specific professions and organisational units within the team (Anumba *et al.* 2002; Bromley *et al.* 2003; Cornick and Mather 1999; Evbuomwan and Anumba 1998; Moore and Dainty 1999; Vyse 2001);
- has a new identity and is co-located, usually in a given common space (Anumba *et al.* 2002; Bromley *et al.* 2003; Strategic Forum for Construction 2003);
- operates in an atmosphere where relationships are equitable, offers its members equal opportunities to contribute to the delivery process and all members are respected (Baiden et al. 2003; Bromley et al. 2003; Dainty et al. 2001; Love and Gunasekaran 1998; Moore and Dainty 1999; Vyse 2001); and
- has a "no blame" culture (Bromley *et al.* 2003; Dainty *et al.* 2001; Evbuomwan and Anumba 1998; Strategic Forum for Construction 2003; Vyse 2001).

These dimensions of integration are summarized in Table 3.6.

Table 3.6 Literature based analysis of dimensions of integration

		Dimensions of integration					
		Single team focus & objectives	Seamless operation with no organisationally defined boundaries	Unrestricted cross-sharing of information	Creation of a single co-located team	Equitable team relationships, equal opportunities & respect for all	"No blame" culture
Literature sources	Anumba *et al* (2002)	√			√		
	Baiden *et al* (2003)	√	√			√	
	Bromley *et al* (2003)	√	√	√	√		√
	Cornick and Mather (1999)	√		√			
	Dainty *et al* (2001)					√	√
	Evbuomwan and Anumba (1998)			√			√
	Love and Gunasekaran (1998)	√					
	Moore and Dainty (1999)	√		√	√		√
	Strategic forum for construction (2003)	√	√		√		√
	Vyse (2001)	√	√	√		√	√

Following on from above literature based dimension of integration and the teamwork assessment matrix in Section 3.4.4, a similar matrix is developed in this thesis. The matrix, known as team integration matrix, will be used to assess the extent of integration achieved within the project delivery team. It comprises the six key dimensions of integration identified above and evidence of practices toward each dimension. The matrix enables the assessment of whether specific practices indicate the achievement of full, partial or no integration. Details of the team integration matrix are shown in Table 3.7.

Table 3.7 Team integration matrix

		Evidence of practice		
		Full integration achieved	**Partial integration achieved**	**Existence of fragmentation**
Dimensions of integration	**Single team focus & objectives**	All members have the same focus and work together towards team objectives.	Members pursue individual objectives but in line with the overall project objectives.	Individually pursued objectives by members without regard or in isolation to others and project objectives.
	Seamless operation without organisational defined boundaries	Members form a new single project team with no individual member identity or boundaries and work toward mutually beneficial outcomes.	Members operate as individuals but make efforts to collaborate with others on the project to meet individual needs.	Continued alignment and affiliation to individual organisations that make up the project team.
	Unrestricted cross-sharing of information	Availability and access to all project information to all parties involved in the project.	Access to project information by a section or sections of the project team.	Project information only available to members with responsibility for the section of work.
	Creation of single and co-located team	A single project team with all members located together in a common office.	Individually operated sub-teams but co-located within a single office environment.	Individually located and operated teams.
	Equitable team relationships, opportunities & respect for all	All members are treated equal, involved in project decision-making process and significant professional capability needed on the project.	Recognition of professional competence, but mainly in their respective field of expertise	Team members' contribution restricted to their functional project role and take decision individually.
	"No blame" culture	Collective identification and resolution of problems. Collective responsibility for all project outcomes.	Cooperation of team members in resolving problems, but with ultimate responsibility resting with a single party.	Individual members are singled out for problems that occur on the project and for undertaking corrective measures.

3.6 SUMMARY

The chapter reviewed the concepts and uses of team, teamwork and integration within organisation. It was highlighted within the chapter that research on teams has increased, especially in multi-skilled environments, and their use leads to outputs higher than the sum of the individuals acting alone. Teamwork, a synergetic process,

is required for information sharing and co-ordination of team members' activities. This is effectively achieved when team members work collaboratively towards common goals in a cooperative environment rather than competing with each other.

The chapter also revealed that integration is required to bring the various organisations that make up the project delivery team to work together more effectively as a single unit. This is because teams within the construction industry are fragmented and unable to derive the full benefits of integration. Team integration will, therefore, bring together different functional disciplines through the free exchange of information among participant in the construction process. Examples of full and effective integration in the construction industry and within project delivery teams are very limited. There is, therefore, the need to explore exemplary project delivery teams to identify key issues that contributed to their success in delivering projects to the satisfaction of all stakeholders.

The next chapter, therefore, reviews methods available for collecting, analysing and interpreting data to meet the objectives of the research. The choices made are also justified to highlight the robust nature of the research.

CHAPTER FOUR - RESEARCH DESIGN AND METHODOLOGY

4.1 INTRODUCTION

Chapter Two reviewed literature on the performance of project delivery within the UK construction. The chapter concluded that the performance of the industry was unacceptable to clients but can be improved if teams within the industry worked collaboratively. Chapter Three then explored the concept of team, teamwork and integration and their potential for improved performance of the project delivery team. The chapter highlighted that the performance of the project delivery team can be improved through integration.

These reviews led to the proposition of the key research questions in Section 1.4. The research questions focussed on the factors that determine the effectiveness of team integration and how integration can be improved within the project delivery team. The aim of the research was, therefore, to improve the integration of the project delivery team. The objectives, necessary to achieve the aim of the research, were then developed. The aim and objectives of the research were discussed in Section 1.5

This chapter discusses the approach and process followed in this research. The availability and selection of appropriate research design and method that would address the key questions raised are also presented in the chapter. This includes the selection and justification for the choice of exploratory interviews, case study approach and framework validation using focus groups. Methods and techniques used in data collection, analyses, and interpretation are also presented.

4.2 RESEARCH APPROACH

4.2.1 PHILOSOPHICAL CONSIDERATIONS

There are a number of considerations that underpin the philosophical position of any research. Several views exist on these positions and the debate continues within the research community on which position best represents an appropriate research design and approach. The two main philosophical positions of social research, discussed below in this section, are ontological and epistemological considerations (Bryman 2004). This thesis clarifies the philosophical stance considered in the course of the research.

4.2.1.1 Ontological consideration

Ontology involves the logical investigation of the different ways in which types of things are thought to exist, and the nature of various kinds of existence. Fitzgerald and Howcroft (1998) indicate that there are relativist and realist ontological positions. The philosophy underpinning this research at the ontological level, discussed in Section 4.2.1.3, is the realist position.

At the ontological level, the realist position is that the external world comprises of pre-existing hard and tangible structures. This structure exists independently of an individual's ability to acquire knowledge. This position is practical and not concerned with abstract or idealistic view of life (Fitzgerald and Howcroft 1998).

The relativist position at the ontological level holds to the multiple existences of realities as subjective constructions of the mind. The perception of reality is directed by socially transmitted terms and varies according to language and culture. Concepts, such as right and wrong, goodness and badness, or truth and falsehood are, therefore, not absolute but change from culture to culture and situation to situation (Fitzgerald and Howcroft 1998).

4.2.1.2 Epistemological consideration

Epistemological issues deal with the question of knowledge acceptability in a discipline. It is "how we know" and the methods through which knowledge are acquired. Epistemological position can be positivist or interpretivist. This research holds on to the positivist epistemological position, which is discussed in Section 4.2.1.3.

The positivist epistemological position advocates the application of natural sciences method to the study of social reality and beyond. It is of the belief that the world conforms to fixed laws of causes and effects, and complex issues can be tackled using simplified or fundamental approach. The position emphasises on objectivity, measurement and repeatability. It is, therefore, possible for the researcher to be objective from a detached position of the research situation. Neutral observation of reality must take place without bias from the researcher (Bryman 2004; Fitzgerald and Howcroft 1998).

The interpretivist epistemological position is contrary to the positivist and hence critical to the application of scientific model to social study. It advocates the absence of a universal truth and places more emphasis on the realism of context. Understanding and interpretation are from the researcher's perspective and point of reference. An uncommitted neutral position is impossible when taking the interpretivist position in research. The researcher is immersed in the research situation and the values and beliefs of the researcher become the driving force in the interpretation of findings (Bryman 2004; Fitzgerald and Howcroft 1998).

Table 4.1 summarises the philosophical considerations discussed in Sections 4.2.1.1 and 4.2.1.2. The philosophical position of this research is then discussed in Section 4.2.1.3.

Table 4.1 Summary of philosophical considerations

Sources: Bryman (2004) and Fitzgerald and Howcroft (1998)

Ontological considerations	
Realist External world comprises pre-existing hard and tangible structures Structures exist independent of individual's ability to acquire knowledge	**Relativist** Existence of multiple realities as subjective construction of the mind Perception of reality is directed by varying socially transmitted terms
Epistemological considerations	
Positivist Application of natural science methods to the study of social reality and beyond World conforms to the laws of causation and complex issues can be resolved by reductionism	**Interpretivist** Absence of universal truth and emphasis on realism of context Understanding and interpretation come from researcher's own frame of reference

4.2.1.3 Philosophical position of this research

At the ontological level, this research adopted a realist position as indicated in Section 4.2.1.1. This is because structures for integrating the project delivery team existed but members sometimes did not recognise and follow the procedures and processes that make them effective. These existing structures for integration within the delivery team and how the structures existed could be investigated and identified respectively. The investigation and identification were necessary if procedures and processes were to be structured and implemented to ensure that the delivery team was integrated more effectively to work together as expected. The research also viewed the investigation to be conducted as practical rather than abstract. Members of the delivery team were directly engaged and existing procedures and processes investigated were evident.

Epistemologically, this research was of the belief that the complex interactions among the various members of the project delivery could be explored through a systematic but simplified piecemeal approach. The conduct of the research could also be carried out without bias and that objective conclusions could be drawn from data collected from a detached position. The adopted epistemological position in this research was, therefore, positivist, as discussed in Section 4.2.2

4.2.2 RESEARCH STRATEGY

Apart from the philosophical considerations underpinning this research (discussed in Section 4.2.1), there is the need for the clarification of the orientation of the researcher to the conduct of research (Bryman 2004). It is the way in which the research objectives are questioned. Two known strategies, quantitative and qualitative research, differ in many ways but can complement each other (Neuman 2003). The decision to follow any particular strategy depends on the purpose of the study, the type and availability of information for the research (Naoum 2002). This research follows a qualitative strategy for the research design and method discussed in Section 4.2.2.2. The two main research strategies are discussed below to clarify the choice adopted in this research which is presented in Section 4.2.2.3.

4.2.2.1 Quantitative research

Quantitative research follows a deductive approach in relation to theory and is concerned with the design measurement and sampling. The strategy employs the use of mathematical and statistical techniques to identify facts and causal relationships. It follows the practices and norms of natural scientific model and particularly, positivism; and viewing social reality as an external, objective reality. Quantitative research is, therefore, objective in nature and based on testing a hypothesis or theory composed of variables (Fitzgerald and Howcroft 1998; Naoum 2002).

Frechtling and Sharp (1997) characterised the common data collection techniques used in quantitative research as questionnaires, tests and existing databases. Hard and reliable data are often collected in quantitative research and, therefore, emphasises on quantification. The samples collected are often large and representative. This means that quantitative research results can be generalised to a larger population within acceptable error limits. Quantitative or "hard" measures are also required for evaluation and can be replicated using sophiscated statistical techniques (Bryman 2004; Fitzgerald and Howcroft 1998). The validity of results depends on the careful choice of measuring instrument and how accurately it measures targets (Patton 2002).

Bryman (2004) outlined the main steps in quantitative research as presented in Figure 4.1 but emphasised that they represents an ideal account of how research should progress. He, however, argued that, though research is rarely linear as depicted in the Figure, it provides a good indication of the interconnections between the main steps in quantitative research.

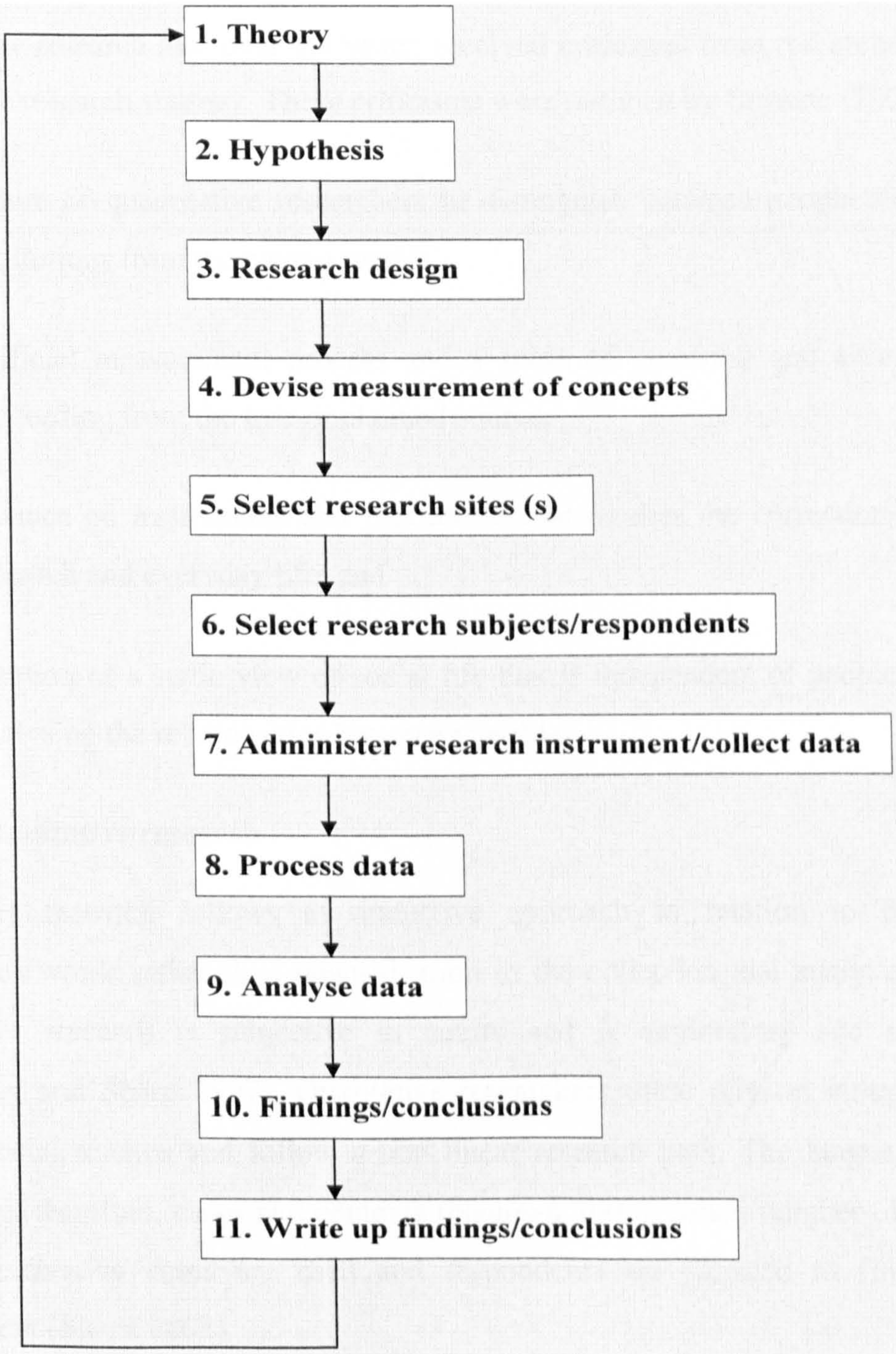

Figure 4.1 Quantitative research process

Source: Bryman (2004)

Naoum (2002) concluded that quantitative research strategy is selected for:

- finding facts about a concept, a question or an attribute; and
- collecting factual evidence and study the relationships between the facts in order to test a particular theory or hypothesis.

Quantitative research has, over the years, received criticisms from researchers as an appropriate research strategy. These criticisms were outlined by Bryman (2004) as:

- failure of quantitative researchers to distinguish between people and social institutions from the natural world;
- artificial measurement process and a sense of precision and accuracy not proceeding from the true or claimed source;
- reliance on instruments and procedures that hinders the correction between research and everyday life; and
- creation of a static view of social life that is independent of people's life in analysing the relationships between variables.

4.2.2.2 Qualitative research

Qualitative research follows an inductive approach in relation to theory. It emphasises words rather than quantification in the collection and analysis of data. Qualitative research is subjective in nature and is exploratory and attitudinal (Frechtling and Sharp 1997). Qualitative researchers often rely on interpretive or critical social science and follow a non linear research path. The language of the strategy is, therefore, cases and contexts (Neuman 2003). Small number of, usually, non-representative cases are used and respondents are selected to fill a given requirement (Sherif 2002).

Qualitative researchers tend to collect three kinds of data; in-depth and open-ended interviews; direct observations and written documents. These yield quotations, descriptions and excerpts which are either unstructured or semi-structured (Patton

2002). The data are soft, rich and deep and determine what things exist rather than how many there are. Consequently, the qualitative research strategy is more responsive to needs and nature of research situation (Fitzgerald and Howcroft 1998). The credibility of qualitative research depends on the skill, competence and the rigor of the researcher (Patton 2002).

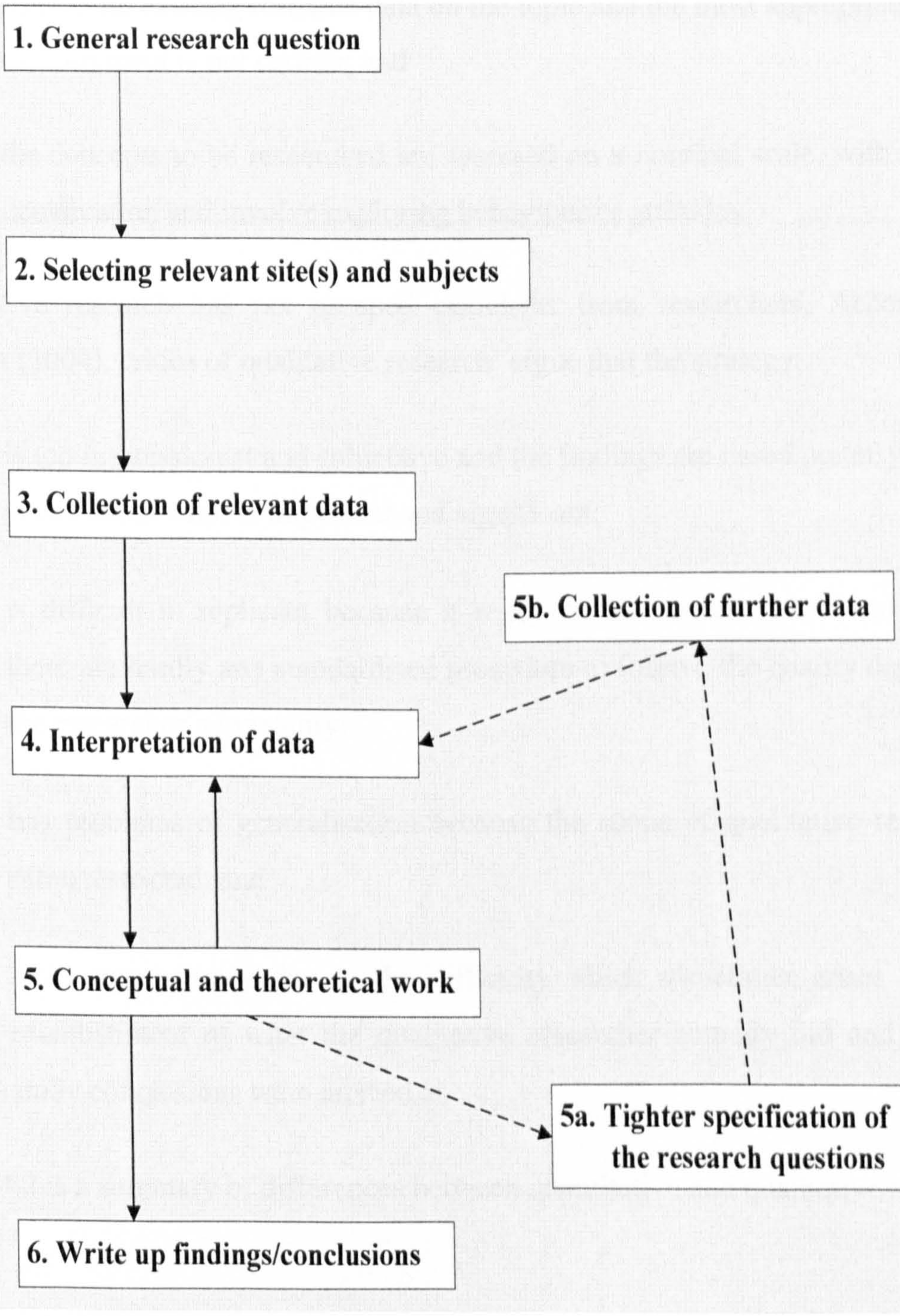

Figure 4.2 Outline of qualitative research process

Source: Bryman (2004)

As presented in Figure 4.2 above, the main steps involved in qualitative research are non-linear and the research questions are driven by theoretical issues which in turn drive the data collection and analysis (Bryman 2004).

A qualitative research strategy may be adopted when:

- there is no existing research data on the topic and the most appropriate unit of measurement is not certain; and

- the concepts to be researched are assessed on a nominal scale, with no clear demarcation and involve exploring behaviour or attitudes.

Qualitative research has not escaped criticisms from researchers. According to Bryman (2004), critics of qualitative research argue that the strategy:

- is too impressionist and subjective and the findings are based on unsystematic views about what is important and significant;

- is difficult to replicate because it relies on unstructured data and because there are hardly any standardised procedure to follow, the quality depends on the researcher's ingenuity;

- has problems of generalisation because the scope of qualitative research is often restricted: and

- lacks transparency due to the difficulty which sometimes arises from the establishment of what the qualitative researcher actually did and how the study conclusions were arrived at.

Table 4.2 is a summary of differences between quantitative and qualitative research.

Table 4.2 Differences between quantitative and qualitative research

Sources: Bryman (2004), Fellow and Liu (2003), Naoum (2002) Neuman (2003) and Sherif (2002)

	Quantitative research	**Qualitative research**
Objective	Gather factual data and study relationships between facts and relationships in accordance with theory.	Study issues in depth and detail and seeks to gain insight and understand people's perceptions..
Orientation to the role of theory to research	Deductive and thus associated with verification of theory and hypothesis testing.	Inductive and geared towards the generation of theory from specific instances.
Common data collection techniques	Questionnaires, tests and existing databases.	Interviews, observations and documents.
Data characteristics	Hard data, structured, large sample size, analysed using statistical methods.	Soft data, descriptive, less structured analysed using non-statistical methods.
Outcome	Conclusive findings used to recommend a final course of action.	Exploratory and/or investigate and findings are contextual.

4.2.2.3 Strategy adopted in this research

A qualitative strategy was adopted in this research for reasons outlined below.

- The research was exploratory and was aimed at providing a holistic approach to improve the integration of the project delivery team through the study of existing practices. The findings and subsequent conclusions drawn in the study were applicable within the context in which the research was carried out. The study did not involve any creation and subsequent testing of a theory or hypothesis, which are associated with quantitative research as identified by Bryman (2004).

- The research explored the factors that influenced the integration of the integration of the project delivery team. The study also covered issues in depth and involved detailed rather than numerous descriptions. The approach was necessary to gain insights needed to appreciate and understand the attitudes and behaviours of the members that made of the team.

- The data available in the research quotations were from interviews and activities observed. They were soft, descriptive and less structured data and had to be collected using techniques such as interviews and observations. The data were analysed using non-statistical techniques and involved the creation of typologies as suggested by Fellow and Liu (2003).

4.2.3 RESEARCH DESIGN

The previous Section, 4.2.2, discussed the research strategy to give a broad orientation to the research and to distinguish between quantitative and qualitative approaches. Having adopted a qualitative strategy for the conduct of the research, this section of the thesis outlines the various frameworks available for data collection and analysis. The research methodology is discussed individually in Sections 4.3, 4.4 and 4.5.

Research design is the structure that guides the execution of the technique for collecting and subsequently, analysing data. It is, therefore, the framework within which the research method is employed. It enables the researcher to connect empirical data to its conclusions, in a logical sequence to the initial research question of the study (Bryman 2004; Yin 2003). Fellow and Liu (2003) and Yin (2003) concluded that options available to construction management and organisational research are largely unstructured, variable and unformulated. However, Bryman (2004) pointed out that the selection of a particular design should be done to reflect the importance with which the researcher attaches to:

- expressing causal connections between variables;
- generalising to larger groups of individuals than those actually forming part of the investigation;
- understanding behaviours and the meaning of that behaviour in its specific social context; and
- having a temporal time appreciation of social phenomena and their interconnections.

Blismas (2001) identified four research designs that are consistently recommended by researchers as viable options in addressing questions posed in both social science and construction management research. He further pointed out that an assessment is required to help decide on an appropriate choice. The main options and the situations for different designs are presented in Table 4.3.

Table 4.3 Recurrent main research designs

Research design	Literature sources
Experiment	Bryman (2004), Fellows and Liu (2003), Yin (2003) and Hammersley and Gomm (2004)
Survey	Bryman (2004) Fellows and Liu (2003), Naoum (2002), Yin (2003) and Hammersley and Gomm (2004)
Action research	Bryman (2004), Fellows and Liu (2003) and Naoum (2002)
Case study	Bryman (2004) Fellows and Liu (2003), Naoum (2002) and Yin (2003) and Hammersley and Gomm (2004)

4.2.3.1 Experiment

Experiments are best suited to bounded problems or issues with known variables or initial hypothesis. They are aimed at the development and testing of theory or practical evaluation of intervention. Experimental research designs test relationships between the research variable and the dependent variables through manipulation. Data for further analysis are collected through observation. Experimental research design are usually not employed directly in social research but only as yardstick against which non-experimental research can be assessed (Bryman 2004; Fellows and Liu 2003; Hammersley and Gomm 2004; Yin 2003). The strength of experimental research design is in its robustness and trustworthiness of causal findings (Bryman 2004).

4.2.3.2 Survey

Surveys are widely accepted research design and involve eliciting information from respondents through questionnaires and interviews (personal and telephone). Data in a survey are collected in a standardised form and from statistically selected samples

to maximise the representativeness in relation to a larger population. Surveys are, therefore, useful means of picturing the current states of groups. They involve far greater numbers than experimental design and can include the relationships between variables' perceptions and behaviours (Bryman 2004; Fellows and Liu 2003; Janes 1999).

Surveys are relatively inexpensive and can cover respondents who are widely dispersed geographically. When an interview approach is adopted, they are flexible and lead to good communication and often high response rate (Sherif 2002). Surveys also enhance the reliability of observations and improve replications because of the inherent standardised measurement and sampling procedures. They permit statistical analysis of data and generalisation to a larger population, which makes them suitable to construction management research (Blismas 2001; Oppenheim 2003).

4.2.3.3 Action research

Action research involves the collaborative diagnosis and evaluation of a problem in which the investigator becomes part of the study. It is often used to propose and validate solutions to particular problems and lies within basic research category. Quantitative and qualitative data are collected in action research, which is a complex process comprising problem formation, action hypothesis, implementation and diagnostic cycle (Bryman 2004; Fellows and Liu 2003). Blismas (2001) indicated that the use of action research in construction is rare due to the increased and intense involvement required of the researcher in the study.

4.2.3.4 Case study

A case study is an in-depth, empirical investigation of specific instances within the research subject. In its basic form, case study research involves the detailed and intensive analysis of a single case and is concerned with all the complexity and the particular nature of the case in question. It can also comprise a number of cases. The richness of the data to be collected may, however, limit the number of cases that can be studied. The selection is often based on their representativeness of cases (Bryman 2004; Fellows and Liu 2003).

The main concern of a case study is the understanding of the context of the case itself. This may exclude any interest in theoretical influences or empirical generalisation, however, the wider relevance of case study findings may be conceptualised (Hammersley and Gomm 2004). Yin (2003) further submitted to the debate on the appropriateness of case study research design by presenting two complementary approaches of the design: presentation of individual case studies; and the use of cases to make broader generalisations.

4.2.3.5 Design adopted in this research

This research follows a case study design due to the high exploratory potential and depth of investigation the design allows for complex relationships among interdependent variables to be studied. The case studies allowed a more holistic approach to be used in determining the factors that were necessary for the integration of the project delivery team. The contextual nature of the research was best served using a case study approach.

The research proceeded with the awareness of the main criticism of case study research design, which is the inability to generalise. Concerns with the validity and rigour of case study research were also taken into consideration. These concerns and criticisms are addressed in Section 4.5.1 of this thesis to further strengthen the choice of case study for the collection and analysis of data for the research.

Other research designs available were not adopted in this research because of the reason outlined below.

- True experiments involve the manipulation of a known variable to determine its influence on dependent variables. This research explored the depth and richness of relationships among interdependent variables rather than direct causal relationships between variables. The level of flexibility and dynamism required to portray the richness of relationship would have been extremely limited within an experimental research design.

- Surveys are rigid in design and do not allow in-depth investigation of issues.

Using surveys would have reduced the exploratory potential of this research required to identify the extent of integration within successful project delivery team within the UK construction industry. The prevalence of widespread fragmentation means that good integration practices can be studied from carefully selected sample. This did not fit a survey approach which relies on large samples for conclusive evidence.

- Action research design was not adopted because the outcomes of this research were to address deficiencies of an existing system and without compromising the level of objectivity. The research focussed on identifying practices within project delivery teams and the best option was to observe them work rather than be part of the working environment. The research was also not a collaborative effort between the studied project delivery teams and the researcher so there was no incentive for the teams to actively commit personnel and time. Their involvements were secured because the outcome was seen to be beneficial to their teams that would deliver future projects.

4.3 RESEARCH PROCESS

As indicated in Section 1.6 of this thesis, the research questions to be addressed were derived from an exploratory and in-depth literature reviews. These reviews provided the relevant theoretical background and framework to undertake the research.

Having determined the philosophical viewpoint, research strategy and design, Sections 4.4, 4.5 and 4.6 highlight the processes adopted to meet the objectives of the research outlined in Section 1.5.2. These objectives were developed to achieve the aim of the research indicated in Section 1.5.1.

The research was carried out in three stages represented in Figure 4.3 and described in Sections 4.3.1, 4.3.2 and 4.3.3.

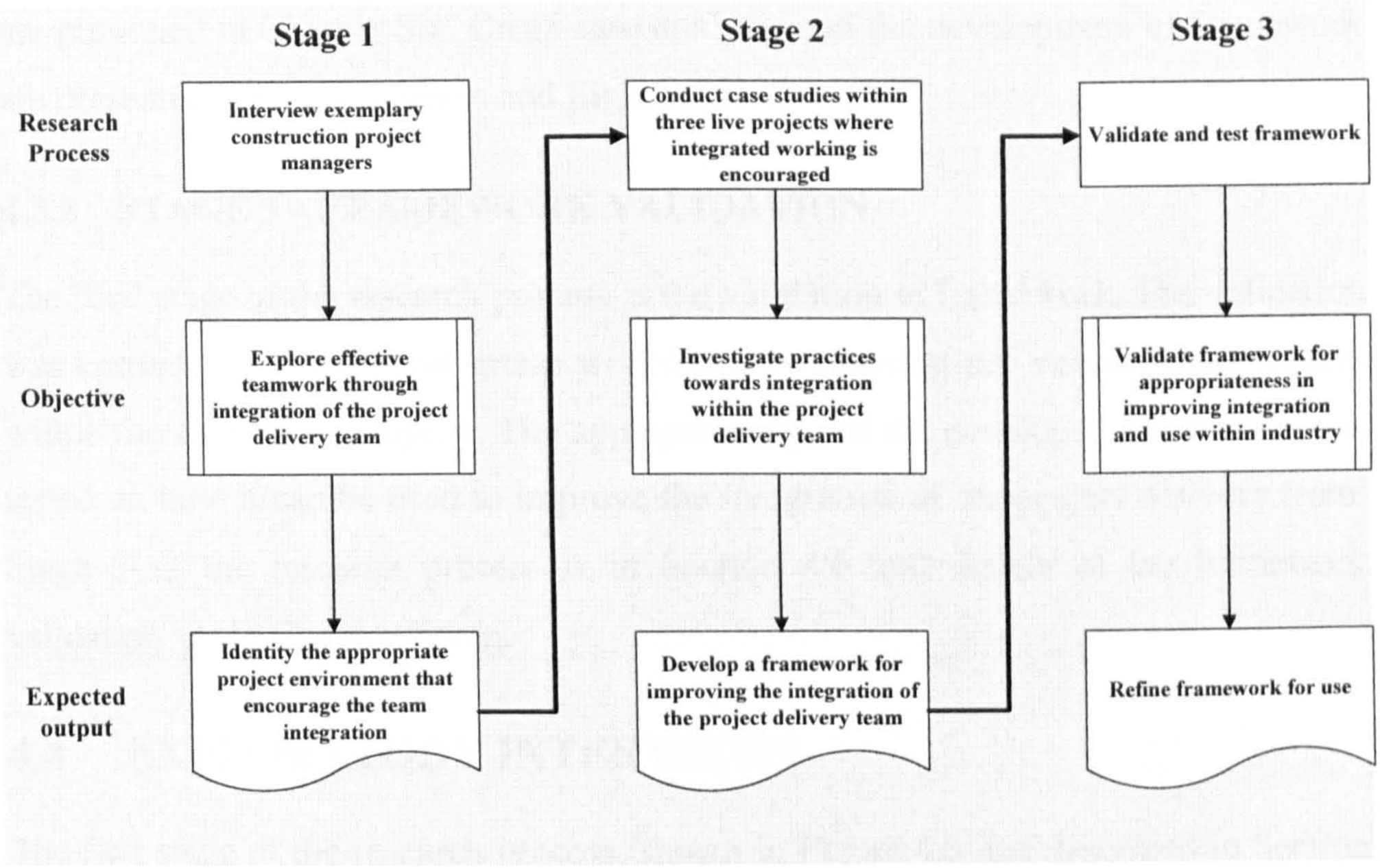

Figure 4.3 Stages of research process

4.3.1 STAGE 1 – EXPLORATORY INTERVIEWS

Exploratory interviews were conducted to identify how leading construction managers have engendered and managed the integration of delivery teams in large projects. The conclusions from the interviews formed the basis for the selection of case study projects. Details of the research process are in Section 4.4 and results, analysis and discussion of interviews are in Chapter Five.

4.3.2 STAGE 2 – CASE STUDIES AND FRAMEWORK DEVELOPMENT

Case studies were conducted within three live projects being delivered through procurement systems that facilitated team integration concluded from the interviews in Stage 1 of the research process. These three projects, managed by previously interviewed leading construction project managers, were studied to explore effective integration practices within the delivery team throughout the construction period. A framework of effective integration practices was developed. Details of the research process are in Section 4.5. Project details, results and discussions of the case studies

are presented in Chapter Six. Cross-case analysis and the development of framework are presented in Chapter Seven and Eight respectively.

4.3.3 STAGE 3 – FRAMEWORK VALIDATION

The final stage of the research process is the validation of framework. The validation was carried out using small group workshops comprising the various team leaders within the case study projects. The appropriateness of the developed framework was tested on how it can be used to improve the integration of the project delivery team. Stage 3 of the research process is in Section 4.6 and details of the framework validation are in Chapter Seven.

4.4 EXPLORATORY INTERVIEWS

The first stage of the research process, shown in Figure 4.3 and described in Section 4.3.1, was to gather information from industry on how and the extent to which successful project delivery teams have worked together on past projects. Interviews were used because, according to Patton (2002), they yield direct quotations from people about their experiences, opinions and feelings. The interviews were, therefore, very credible way of obtaining information from leading construction project managers.

Interviews can be exploratory or standardised (Oppenheim 2003). This research follows an exploratory approach to allow depth and flexibility in administration and thematic in its analysis. Exploratory interviews are useful when an idea is being developed. They attempt to understand how people think and feel about the issues being researched (Patton 2002; Schensul et al. 1999). This approach was used because the research at this stage was to gather ideas to inform and refine the research objectives and to help select appropriate projects for further in-depth study. It involved gathering the opinions of leading construction managers on how team integration influenced teamwork and consequently, improved project delivery.

A standardised interview was not adopted for this research because it is more suited to data collection from a large scale sample. It is used when the research objectives and the hypothesis have been already established (Patton 2002). The small stratified

sample and the absence of a hypothesis at this stage of the research meant that standardised interviews could not be used. Moreover, standardised interviews are used more in quantitative rather than qualitative research where the degree of inquiry and exploration are severely limited. The information sought in this research was more descriptive and in-depth rather than quantitative.

4.4.1 TYPES OF INTERVIEWS

Interviews are used when data are to be collected to understand complex behaviours and processes in depth (Patton 2002; Schensul et al. 1999). Interviews, therefore, follow given lines of enquiry but are fluid in nature rather than rigid. Interviews vary in their nature and can be structured, semi-structured or unstructured (Legard et al. 2003; Patton 2002). Wisker (2001) indicated that the nature of interviews form a continuum, as shown in Figure 4.4, with unstructured and structured interview at the extreme and semi-structured in between. The main characteristics of the three main interview types are summarised in Table 4.4.

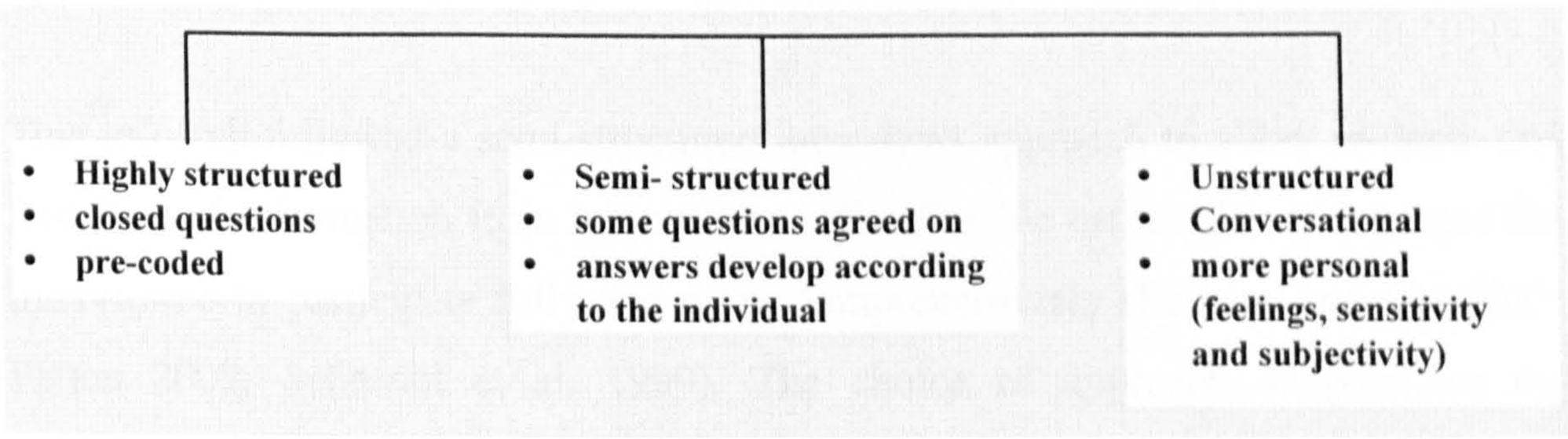

Figure 4.4 The interview continuum

Source: Wisker (2001)

Table 4.4 Main characteristics of interview types

Sources: Bryman (2004), Fellows and Liu (2003), Legard (2003), and Patton (2002)

Type of interview	Main characteristics
Structured	- data collected through formal style of questioning; - little scope for probing responses; - supplementary questions required to obtain more details and pursue new aspects; - respondents choose an answer from alternatives; and - same wording and question for all interviewees;
Semi- structured	- data collected through both formal and informal styles of questioning; - responses can be written and supplemented with recording; - responses limited to subject in question but interviewee is free to add more details if the need be; - provides more details about issue being investigated; - respondents provide topical answers; and - all respondents receive the same major issues.
Unstructured	- data collected through informal style of questioning; - recording responses is most suitable; - respondents say as much as they wish after a brief introduction by the interviewer; - they can be monologues with few prompts to ensure completion of statements; - answers are provided by respondent in any order they so wish; and - brief introduction of same key issues to all respondents.

This research followed a semi-structured interviews approach to allow in-depth and free flow of information from interviewees. The flexible nature also encouraged the interviewee to participate fully and more comprehensively (Fellows and Liu 2003; Patton 2002; Schensul et al. 1999). The choice of approach adopted for the interviews are discussed in Section 4.4.2.

4.4.2 APPROACH TO INTERVIEWS DESIGN

There are three main approaches to interview design within each interview type discussed in Section 4.4.1. The difference, according to Patton (2002), is based on the extent to which interview questions are determined and standardised before the interview takes place. These are:

1. Informal conversation interview;

2. Interview guide approach; and

3. standardised open-ended interview.

In informal conversation interviews, questions are generated spontaneously with a natural flow of interaction within an immediate context. This could be part of an on-going participant observation data collection and there may be no predetermined questions or topics. The person involved in the interview may not notice that they are being interviewed. Informal conversation interviews increase questioning importance and relevance and can be matched to individuals. The flexibility in questioning can result in different information being collected from different people. The usefulness of data collected depends on the type of questions asked and do not occur naturally. This makes organisation and analysis of data very difficult (Bryman 2004; Oppenheim 2003; Patton 2002).

The interview guide approach is very useful when issues are to be explored. The interviewer outlines the issues or topics to be covered in the interview guide given out to the interviewees in advance. This guide then serves as a checklist during the interview to ensure that all the relevant issues are covered. The approach is more comprehensive and more systematic in collecting data and anticipated data gaps can be closed. Comparability of responses can be reduced due to the flexibility in the guide preparation (Oppenheim 2003; Patton 2002).

Standardised open-ended interviews enable the same questions to be posed to a number of respondents. They are rigid and do not allowing probing. Wording and sequencing must be done to ensure that all relevant issues are covered in the interview. Data completeness comparability is greatly enhanced because respondents answer the same questions. The interviewer's bias is also reduced. There is, however, limited flexibility and standardisation limit the relevance and natural flow of answers (Patton 2002).

This research followed a combination strategy in the interview approach to increase the richness of the data collection. The combination strategy follows the submission by Patton (2002) that the three main interview approaches discussed above are not

mutually exclusive. An interview guide approach was adopted to ensure that all issues to be explored were covered during the interviews. The restriction imposed when an interview guide is used were, however, removed to allow interviewees to elaborate more on issues that were relevant and important to the performance of the project delivery team. The interviews took longer in cases where the respondent dwelt much more on issues outside what is being sought in the research. This combination approach increased the flexibility of the interviews and enabled more relevant data to be gathered in a relaxed atmosphere. The approach also allowed the objectives of the interviews to be achieved through the guide, which are both presented in Section 4.4.3.

4.4.3 INTERVIEW OBJECTIVES AND GUIDE

The exploratory semi-structured interviews were conducted in this research to explore expert opinions and knowledge from exemplary project managers on integration of project delivery teams. The objectives of the interview were directed at providing a further focus for the research and to select the appropriate project for case study. The main objectives were to:

- explore how the teams are formed, managed and maintained throughout the project to perform at the highest level;
- identify the key contributory factors that enhanced or impeded the integration of the project delivery team; and
- determine what can be done to improve the level of integration within the team.

To achieve the above objectives, an interview guide was developed and given to the interviewees prior to the interviews. The guide covered the following issues:

- the context within which the project was executed;
- composition and management of the project delivery team;
- team dynamics, interactions, processes and structures towards integration

during the construction period;

- internal and external influences on the performance of the team; and
- lessons on integration learnt on the project and their likely impact on future projects.

4.4.4 INTERVIEWEE SELECTION

Interviews are conducted in research to understand the perspective of the interviewee so their selection becomes a crucial part in the richness and depth of information obtained (Miles and Huberman 1994). In this research, the interviews sought to draw upon expert knowledge and the selection of interviewees was done to reduce biasness and controversy. This is because the definition of a successful project manager continues to generate considerable debate and controversy. Traditional success criteria have also been argued as being too simplistic in the context of today's complex construction project environment (Dainty et al. 2003).

Construction project managers who have been acknowledged to have excelled in the management of project teams measured against a wide range of assessment criteria were selected. The reason for the selection was to explore practices and opinions from the very best in the industry. The Chartered Institute of Builders (CIOB) Construction Manager of the Year Awards (formerly Building Manager of the Awards) provided an objective way of identifying successful construction project managers. The award is for managers with overall responsibility for delivery of construction projects.

Eleven Construction Project Managers received awards between 2000 and 2003, in the "large projects" category (currently those over £45 million) for their key roles in the management of completed projects. Nine of the eleven Project Managers responsible for these projects agreed to take part in the research and were subsequently interviewed. More details of the interviews are provided in Chapter Five.

4.4.5 METHOD OF ANALYSIS

Qualitative data analysis is a challenging process and requires creativity and systematic searching. The analysis of qualitative data takes place in four stages: data reduction, data display, conclusion drawing and verification. These stages occur throughout the duration of any qualitative research project (Miles and Huberman 1994). The analysis can be done manually, when the volume of data is manageable, and information technology (IT) tools are available for large volumes of data (Miles and Huberman 1994; Seale 2005; Spencer et al. 2003).

An adapted form of "framework analysis" was used in the research to analyse data from the exploratory interviews. Framework analysis is an inductive matrix-based method of qualitative data analysis used for ordering and synthesising data under conceptual headings emerging from the field of enquiry. The method helps to define concepts, create typologies, find associations and seek explanations for the emerging phenomena. It also allows the sifting, charting and sorting of data into key issues and themes and enables rapid comparison of research findings across the cases investigated (Ritchie and Spencer 2002).

The process followed in analysing the interview data is described below.

- The interviews were transcribed verbatim. This is because interview data are in the form of words and have to be translated into text for further manipulations.

- To make any meaning out the data, they were sorted into emerging themes.

- In-case and cross-case assessments of teamwork and integration, using the teamwork effectiveness matrix and team integration matrix discussed in Sections 3.4.4 and 3.5.4, within the team managed by the interviewees were then carried out.

The results and discussion are detailed in Chapter Five of the thesis. The conclusions from the interviews provided the basis for the selection of case study projects. The

research design and method are discussed in details in Section 4.5 and the results and discussion in Chapter Six.

4.5 CASE STUDIES

The second stage of the research process, represented in Figure 4.3 and highlighted in Section 4.3.2, was to conduct case studies using projects that were procured through systems that facilitated integrated working. The case studies investigated practices toward team integration practices within three live project delivery team led by exemplary project managers who participated in the interviews at the first stage of the research process. The choice of case studies approach was discussed earlier in Section 4.2.3.5. This section discusses the research process in detail.

A case study is an empirical and comprehensive approach, appropriate for the holistic study of a case or cases. The design is logical and meets the quality criteria of validity and reliability (Yin 2003). The unit of analysis of the case study must also be clear (Fellows and Liu 2003). Case study approach is comparatively flexible, contextual and emphasises exploration rather than prescription or prediction. It, therefore, enables the investigator to discover and address issues as they arise in the course of the research. Case study research can, however, inherently be subjective and ethical consideration would have to be dealt with comprehensively (Becker et al. 2005).

The distinctive nature of case studies as indicated by Yin (2003), means that they have to be precisely shaped to yield desired results. Research activities involving numerous contextual variables which are qualitatively different are best carried out using case study approach. This is because case studies allow the use of multiple data collection techniques (Fellows and Liu 2003). Case study research includes both single and multiple case studies.

To effectively study the complex relationships that go the shape the integration of the delivery team within a construction project environment, reliance on multiple data collection techniques would be most appropriate. This is because of the richness of data required to comprehensively provide an in-depth picture of the interaction

among the various members of the team. This is in addition to the reason given for the choice of case studies in Section 4.2.3.5. The choice of the approach is followed by the selection of an appropriate design to enable the relevant data to be collected. The various designs available and the choice of the design used in this research are discussed in Section 4.5.1 below.

4.5.1 CASE STUDY DESIGN

The case study design is the logic that links the data to be collected in the research to the initial questions. It can also be described as the framework within which data are collected and analysed. The design is more than a work plan and the main purpose is to avoid collecting data that does not address the research questions (Fellows and Liu 2003; Yin 2003). There are four basic types of case study design. These are outlined in Figure 4.5

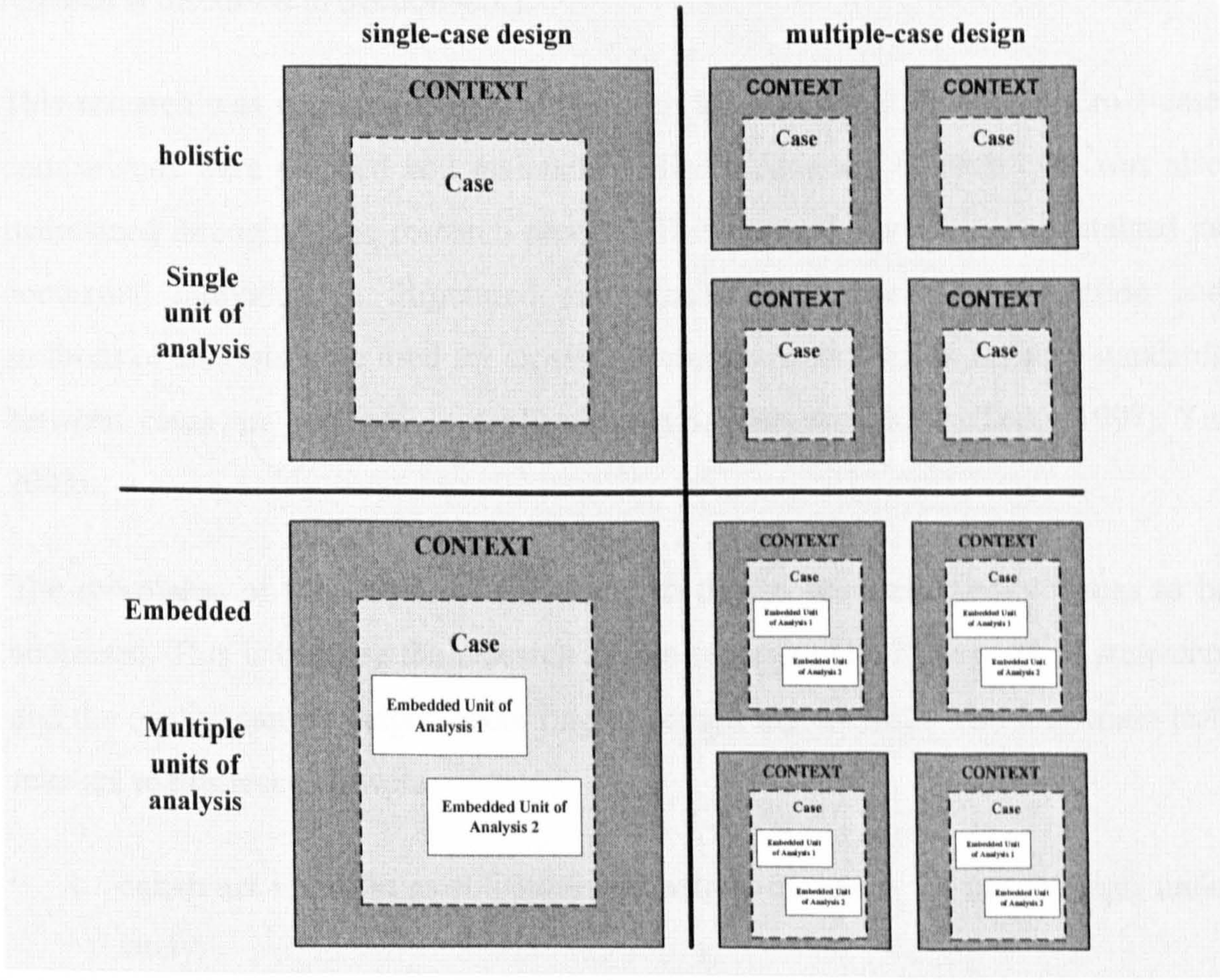

Figure 4.5 Basic types of designs for case studies

Source: Yin (2003) sourced from Cosmos Corporation

The resultant four types of designs for case studies are:

1. Single-case holistic;
2. Single-case embedded;
3. Multiple-case holistic; and
4. Multiple-case embedded.

Case studies follow either single or multiple-case designs and each can be made up of either holistic or embedded units. The choice of design depends on the unit of analysis and the case being investigated. This research follows a multiple-case (embedded) design approach. The choice is based on the robustness of the design and enhanced results generalisation it offers. The case study design adopted in this research is discussed in Section 4.5.2.

This research was conducted using replication logic, and not sampling. Cross-case comparisons were planned and maintained. The uniqueness of each case was also maintained throughout the research process. This ensured that each case retained its contextual individuality. Structured and standardised processes, collection and methods of analysis were used for cross-case comparisons. This is because standards between cases are required in replication logic (Bryman 2004; Tellis 1997; Yin 2003).

The robustness of the choice of this research design required quality issues to be addressed. This is because the research design represented a logical set of statement and the quality can be judged according to certain logical tests. The four main tests relevant to this research were:

1. **construct validity:** establishment of correct measures for the concepts under study;
2. **internal validity:** establishment of a causal relationship, whereby certain conditions are shown to lead to other conditions, as distinguished from false

relationships;

3. **external validity:** establishing the domain to which a study findings can be generalised; and

4. **Reliability:** demonstrating that the operations of a study can be repeated with the same results.

The tests, suggested tactics and how they were achieved in this research are summarised in Table 4.5

Table 4.5 Logic test tactics and measures taken within research design

Source: Yin (2003) sourced from Cosmos Corporation

Logical test	Suggested tactics	How it was achieved within research
Construct validity	use of multiple source of evidence establish chain of evidence have key informants review draft case study report	evidence from multiple sources interview with different personnel with different perspectives studying of documents
Internal validity	do pattern-matching do explanation-building address rival explanation use logic models	case selection based on findings of exploratory interviews but with theoretical influence use of multiple sources triangulation
External validity	use replication in multiple-case study	replication logic design cross-case comparisons
Reliability	use case study protocol develop case study database	case study protocol established throughout the report case study database maintained

4.5.2 CASES, UNITS OF ANALYSIS AND EMBEDDED UNITS

Clear definition and selection of cases are extremely important in case study research design. The case definition is needed to impose the level at which the study would be conducted and is defined based on the level of specificity with which an object or activity is viewed. The three levels of specificity that require definition based on the

research questions are cases, units of analysis and embedded units (Blismas 2001; Tellis 1997; Yin 2003). The levels and units defined for the research are summarised in Table 4.6.

Table 4.6 Levels and units defined for the research

Level	***Units defined for the research***
Cases	*Large design and build project*
Unit of analysis	*Project delivery team*
Embedded units	*Design, construction and management teams*

The case study approach was used to explore effective integration of the project delivery team through the investigation of three live case study projects managed by exemplary project managers. This was to address the research questions of identifying the key factors that determine the effectiveness of integration within the project delivery team and explore how the integration of the project delivery team can be improved for the efficient delivery of a construction project.

The delivery teams explored within this research operated within the project environments. The highest levels of investigation, from which the delivery team can be viewed, were the projects. The cases for this research were large design and build projects. The "large" categorisation of projects is according to the CIOB classification, currently, over £40 million.

The project delivery teams were defined as the unit of analysis. This is because the research focussed on practices within the project delivery team that enhanced or impeded their integration. This included the design, construction and management teams based on site and directly responsible for building of the project. It excluded the clients' team from the study but their influence and that of other stakeholders of the project were considered in the study.

Finer units that can be studied and analysed with a case is termed as the embedded units. The clarity of distinction between the three levels of specificity may be

difficult but embedded units are the sub units within the case. The design, construction and management teams that make up the project delivery team were defined as the embedded units within this research. This is because these teams were identifiable on sites and their activities were similarly defined. They worked, or were supposed to work together, as a sub-team and be part of the overall project delivery team.

4.5.3 CASE SELECTION

There are differing opinions on the choice of cases. Two schools of thought on case sampling are randomised and theoretical sampling. A self-selection principle of random and unbiased choice has been pursued and argued as a valid selection strategy. Miles and Huberman (1994) argued that random selection of cases reduces the potential richness and variety of findings in case studies. Yin (2003) indicated that cases are chosen to literally or theoretically replicate other cases or to extent emergent theory, or to fulfil categories and provide polar examples.

The selection of cases in this research follows a deliberate sampling approach. Three cases were carefully selected due to the following reasons.

- They were procured using a system, design and build, which enhanced the integration of the project delivery team. This followed the conclusions of interviews conducted at the first stage of the research process. The selection was to enhance the investigation of integration practices within the best possible environment where the various teams were expected to work together within the framework of the contractual procurement arrangement.

- They were managed by exemplary construction project managers who were involved in the exploratory interviews to explore the extent of integration within the UK construction industry. This ensured that the delivery teams were managed by the very best in the industry who have been successful on previous project. It also ensured consistency within the team in engendering good practices that would have come from previous projects.

- There was easy access to personnel, documents and information which was necessary for in-depth investigative study. The access gained allowed for following up of issues that needed more explanations or expositions with personnel in order to gain more understanding of issues and insight into observed practices.

- Each case was unique and at a different stage of completion but they collectively presented a holistic view of development process of the project delivery team. Discussion in Section 3.3.2 indicated that teams develop into full maturity over time. The selection also allowed the investigation of team dynamics and impact on integration throughout the key stages of team development.

- The good geographical spread throughout England enhanced the exploration of the influence of local culture and attitude of team members on working practices within the project delivery team.

The number of cases in a multiple-case study goes beyond sampling logic and typical criteria regarding sample size are irrelevant (Yin 2003). The decision should rather be based on the number of case replications and is a discretionary matter. The selection should be guided by the number of replications that will provide you with an appropriate level of certainty. Larger numbers are favoured when the external conditions will produce different case study result. External conditions were considered in the research but only for their influence on the internal project delivery team. Two or three replications are, therefore, reasonable within such conditions. This research therefore selected three cases to reflect the reasonable replications put forward by Yin (2003).

4.5.4 DATA COLLECTION

There are six sources where data can be collected in a case study research. These sources have strengths and weaknesses and no single source has a complete advantage over the rest. Yin (2003) recommends the use of multiple sources of data collection as the various sources complement each other. The six data sources are; documentation, archival records, interviews, direct/non-participant observations,

participant observation and physical artefacts. The strength and weaknesses of the above data sources are summarised in Table 4.7. The sources of data from which data were in the case studies are justified below. These were based on the strengths and weaknesses of each source highlighted in Table 4.7.

Table 4.7 Strengths and weaknesses of data sources

Source: Yin (2003)

Data source	Strengths	Weaknesses
Documentation	• stable,- can be reviewed repeatedly • unobtrusive - not created as a result of the case study • exact - contains exact names and reference and event details • broad coverage – long time span, many events and settings	• retrievability – can be low • biased selectivity from incomplete collection • reporting bias - reflect unknown author bias • access – can be restricted
Archival records	• same strengths as documentation • precise and quantitative	• same weaknesses as documentation • accessibility due to privacy reasons
Interviews	• targeted – directly focussed on case study • insightful – provides perceived causal inference	• bias if question are poorly constructed • bias response likely • inaccuracies when recollection is poor • reflexivity – interviewee gives what interviewer wants to hear
Direct /Non-participant observation	• reality – covers events in real time • contextual – covers the context of the event	• expensive and time-consuming • can be selected unless broad coverage • reflexivity – events may proceed differently from what is being observed
Participant observation	• same as for direct observation • insight into interpersonal behaviour and motives	• same as for direct observation • bias due to investigator's manipulation of events
Physical artefacts	• insightful into cultural features • insightful into technical operations	• selectivity • availability

4.5.4.1 Choice of data sources

Archival records were not used as data source because they include confidential records which could not be made available to persons outside of the organisation. Participant observation was not adopted because the research did not intend to investigate or explore interpersonal behaviours and motives. It also improved the objective position of the research as the researcher was not and did not manipulate or influence events within the project delivery team. The nature and duration of study did not allow involvement on confidentiality issues and, therefore, physical artefacts were not used as data sources. Practices within the delivery team toward integration could be adequately explored without going into confidential issues.

Documentation, interviews and direct/non-participant observations were the main methods of data collection in the research. Interviews and direct observation provided most of the data. Data on organisation structure and company profile were collected through the use of documentation. Triangulation was achieved using multiple sources of data in interviews and observations This improved the internal validity of the research, a logical test requirement previously discussed in Section 4.5.1 (Tellis 1997; Yin 2003). The types and elements of triangulation used in the research are summarised in Table 4.8.

Table 4.8 Types and elements of triangulation

Type of Triangulation	**Elements of triangulation**
Methodological	• interviews • observation • documentation
Data	• multiple observation of project team members • semi-structured interviews with different team leaders and members

The robustness in the choice of data sources used in this research was achieved in two ways. Methodologically, more than one data source was used. Interviews, as data sources, were used to gain further understanding of observed instances. These were supplemented through documentation where they were relevant and available.

The sourcing of data also involved the use of multiple observations of the project team members. These were complemented by interviews with different team members and leaders of the various functional teams within the project delivery team. Details of the data collection sources are provided in Sections 4.5.4.2, 4.5.4.3 and 4.5.4.4

4.5.4.2 Observation

The main source of data collection was direct observation. Observation as a data collection technique can be difficult and complex but it is one of the most versatile methods of information gathering. There are strengths and weaknesses of the technique. Simpson and Tuson (1995) indicate that observation gives both direct access and allow permanent and systematic records of social interactions. It can be used to enrich and supplement data gathered by other techniques. Observation techniques are also extremely flexible and can be used in any research strategy.

The technique often needs considerable time, effort and resources. It is also susceptible to observer bias. The first weakness of the observation was never encountered throughout the research, due to advance planning and preparation of a financial plan to conduct studies. To remove observer bias, opinions formed or trends observed were verified through interviews conducted with team leaders. This approach was used due to that fact that multiple observations using more than one observer was not possible in the research.

The research employed a semi-structured approach to observation (Slack and Rowley 2000). The approach allowed a focus on observable behaviours that occurred regularly. It then enabled the identification factors associated with the domain, variables associated with the factors and the attributes of the variables that were recorded (Schensul et al. 1999). The research used semi-structured observation because the case studies were to further explore and investigate integration practices that have been established through literature review and exploratory expert interviews. This implied that particular attention was paid to incidents of interest to team integration. This was necessary to focus the observations and make appropriate

requests for situation and places where the various project delivery team members were expected to work together.

Several methods exist for collecting data when using observations (Kellehear 1993). These include:

1. written and audio-visual records;
2. material culture;
3. simple observation; and
4. hardware techniques including camera, video, etc.

This research used a simple observation method for collection of data. The steps below, suggested by Kellehear (1993),were followed in each case.

- Definition of interest - this included all members of the project delivery team, how they interacted with each other's social and physical setting.
- Sample selection – this involved recording anything of interest in relation to collaborative working, focussing on groupings within the project delivery, observing the way they behaviour and noting when specific behaviour occurs.
- Recording approach – incidents were recorded as and when they occurred.
- Recording device – written notes and checklist.
- Planning – this involved familiarising the settings of the project site.
- Observation – this included observing the physical and geographical setting, team members and their movements, time and social occasions, attitudes and way of behaviour of all members.

4.5.4.3 Interview

Semi-structured interview was selected as the main data collection technique. This is because of the level of probing it allows without losing control on issues that have to be discussed. The interviews were used to clarify and provide more details on issues that were observed. This was in line with the conclusions by Slack and Rowley (2000) that cognitive information, such as beliefs, motivation and perception can be obtained by interviewing the observed. Persistent questioning was avoided to eliminate bias and interviewees were assumed to have in-depth or expert knowledge of the research problem. The groups selected for the interviews are detailed in Table 4.9.

Table 4.9 Details of interview groups

Team	Description	Members interviewed
Management team	Management of design, construction and administration of contract	Project Director, Project Manager, Project Planner, Project Engineer
Design team	Design and detailing of works	Design Manager, Project Architect, Services/M & E Engineer, Structural Engineers
Construction team	Construction of work and design and construction of work packages	Construction Manager, Package Cons tractor's representative

Twenty-four interviews (eight in each case study), which lasted between 30 and 45 minutes, were conducted and the details are shown in Table 4.10.

Table 4.10 Interviewees details

Interviewee position	**Case 1**	**Case 2**	**Case 3**
Team leaders			
Project Management	1	1	1
Design	1	1	1
Construction	1	1	1
Team members			
Project Management	2	2	2
Design	1	1	1
Construction	2	2	2
Total	**8**	**8**	**8**

These interviews provided more details and understanding of practices and procedures within individual functional and organisational team as well as the overall project delivery team. Interviewees were selected due the following reasons:

- they could offer further details and explanation to observed incidents, pattern of behaviour and working approach;

- their functional role was critical to the integration of the project delivery team and could also provide more information relating to either their team or the overall project delivery team; and

- they were willing and had the time to be interviewed.

4.5.4.4 Documentation

Very little use of documentation was employed in the collection of data. They included the following.

- **Organisation charts** – this was to explain the role and function of the various members within the project delivery team. This was done to distinguish between what people are actually called and the role they perform on the project.

- **Project profile** – this gave an indication of the kind of project and the various

stakeholder who have an influence of how the project progressed.

- **Company profile** – background information of the company and possible unearthing of policies and cultures that run though the project.

4.5.5 DATA ANALYSIS

Data analysis comprises examining, categorising, tabulating and testing evidence to address the initial study proposition. Analysis of data in a case study is often difficult because the strategies and techniques have not been well defined by past research. It is, therefore, important and helpful that familiar tools and techniques are used (Yin 2003). The need for a general analytic strategy, which is geared towards defining priorities of what to analyse and why, cannot be overlooked (Miles and Huberman 1994). This section deals with the strategy and techniques used to analyse the data collected from sources described in Section 4.5.4

4.5.5.1 Analytical strategy

Case study analysis is one of the least developed and the most difficult aspect of the research design. It is a challenging and exciting stage of the research process and requires a mix creativity and systematic searching (Spencer et al. 2003). Yin (2003) places emphasis on the choice of an analytic strategy as the first determinant in case study analysis. This is important if the data collected in the case study are to be analysed meaningfully. Three such strategies exists and these are described by Yin (2003) as:

1. **theoretical proposition** – following a theoretical proposition that led to the case studies;
2. **rival explanations** – defining and testing rival explanations; and
3. **case description** – developing a descriptive framework for organising the case studies.

This research follows a theoretical proposition as a general analytic strategy. This is because the case studies were based on exploring further, findings of exploratory

interviews conducted to investigate the extent of team integration within the UK construction industry. The above analytical strategy was adopted for each and across the three cases.

4.5.5.2 Analytic technique

Several analytic techniques exist and none is considered by Yin (2003) as easy to use. Yin (2003) further outlined these techniques as:

- **Pattern matching** – comparing empirically based pattern with predicted ones;
- **Explanation building** – data analysis by building an explanation about the case;
- **Time-series** - repeated occurrence of a pattern or variable;
- **Logic models** – matching events observed empirically with theoretical predictions; and
- **Cross-case synthesis** – aggregation of findings across a series of individual cases.

All the techniques, with the exception of cross-case synthesis, can be applied within a single or multiple-case study. This research followed the logic model technique (Yin 2003) and the data and the pattern observed were displayed using a thematic framework discussed in Section 4.4.5. The details of the analysis of individual cases are discussed in Chapter Six and cross-case analysis in Chapter Seven of the thesis.

The process followed in analysing the interview data is described below.

- The interviews were transcribed verbatim. This is because the data collected were in the form of words and have to be translated into text for analysis.
- To make any meaning out the data, they were sorted into emerging themes.
- In-case and cross-case assessments of integration within the team managed by the interviewees were then carried with literature based dimensions.

4.6 FRAMEWORK VALIDATION

The final stage of the of the research process described in Section 4.3.3 and shown in Figure 4.3 involved the validation of a framework developed from the case studies conducted during the second stage of the research process. The framework comprised factors that influenced the integration of the project delivery team. It provided a solution to how integration could be improved continuously over the project duration

The framework was validated using a workshop comprising functional team leaders of the three case study projects. Validating the framework within the same environment in which data were collected enabled the assessment of how appropriate the framework was. It also preserved the context within which the framework was to be applied.

Validation is used in many fields of research but generally, it is a process of checking if something satisfies a certain criterion. This could, for example, involve checking if a statement is true or an appliance works as intended (Wikipedia 2005). Validation improves the credibility of findings in a research, especially where the research has been conducted from an outsider perspective (Lincoln and Guba 1985)

Respondent or member validation has been widely used to check the research findings and this research adopted the same approach (Bloor 2004; Bryman 2004; Mays and Pope 2000). Respondent validation involves cross checking interim research with respondents. It ensures a good correspondence between research findings and the research participant (Bryman 2004). Feedback from the respondents are incorporated in the findings (Mays and Pope 2000). The validation process is presented in detail in Chapter Eight

4.7 SUMMARY

The chapter discusses the philosophical underpinning of the research and the choices made in research strategy, design and methods. Available strategies, designs and methodologies were highlighted to clarify the reasons a particular selection in the research. The data collected and the methods of analysis were also discussed.

Philosophically, research adopted the positivist epistemological and the realist ontological positions. The choice of qualitative strategy adopted in the research was justified. The decision to follow the strategy was based on the purpose of the study, the type and availability of information for the research. The main differences between quantitative and qualitative research strategies were highlighted.

Experiments, survey, action research and case study are designs that guide the execution of the technique for collecting and subsequently, analysing data connect empirical data to its conclusions, in a logical sequence to the initial research question of the study. Case study design was selected due to the high exploratory potential and depth of investigation it allows for complex relationships among interdependent variables to be studied. Case studies allow the contextual nature of the research to be maintained.

The research proceeded in three stages. At the first stage, semi-structured interviews were conducted to explore how leading construction managers have engendered and managed the integration of delivery teams in large projects. The interviews were transcribed verbatim and analysed using an adapted framework. Details are presented in Chapter Five.

A multiple case study design comprising three large design and build projects was selected to further explore effective integration practices within live project delivery teams on construction projects at various stages of completion at the second stage of the research process. Data were collected through observation, interviews and documentation. A logic model with a theoretical proposition analytic strategy was adopted. Chapter Six describes the three case study projects. Thematic framework was used to analyse the data both within and across the three cases. Findings from

the case studies were used to develop a framework. Details of the cross-case analyis of key integration issue and their implications are presented in Chapters Seven.

The third and final stage of the research process involved the validation of the framework developed to improve the integration of the project delivery team. Respondent validation was used to assess the level of acceptance of the research finding among the respondents who participated in the research and the appropriateness of the developed framework. Details of the framework and the validation are presented in Chapter Eight.

Having determined the appropriate research approach, strategies and design, Chapters Five to Eight discuss in detail the various stages of the research process shown in Figure 4.3. The first stage, which is the conduct of exploratory interviews with nine award-winning construction project managers, is presented in Chapter Five.

CHAPTER FIVE – FACTORS INFLUENCING THE INTEGRATION OF PROJECT DELIVERY TEAMS

5.1 INTRODUCTION

Literature reviews in Chapters Two and Three concluded that clients are not satisfied with the overall performance of the construction industry. In spite of the changes in procurement arrangements towards more integrated approaches, successive industry reports continue to highlight poor project delivery within the industry. The use of integrated processes and teams in the delivery process has been suggested as means of improving the performance of the industry (Egan 2002). Examples of successful integration have, however, been limited to projects set out to demonstrate the benefits of proposals put forward by industry. True industry-wide examples of successful teamwork through integration are, therefore, limited (Payne et al. 2003; Strategic Forum for Construction 2003; Vyse 2001).

In spite of the criticism of the construction industry's poor performance, there are exemplary project delivery teams within industry that can be explored for good practices. The existence of limited examples of good delivery teams call for in-depth investigation that can be achieved through exploratory interviews (Chrzanowska 2002; Legard et al. 2003; Oppenheim 2003). The approach, as discussed in Section 4.4, is necessary to focus the research to find how construction project delivery teams can be effectively integrated during the execution period.

This chapter presents results, analysis and discussion of findings of the first stage of the research process discussed in Section 4.3 and shown in Figure 4.3 of Chapter Four. The chapter presents exploratory industry-based interviews with award-winning construction project managers. Details of projects managed by the award winners, interview data, analyses, and discussion of key factors influencing the integration of teams are discussed in the chapter. The chapter concludes with the justification for the selection of case study projects presented in the Chapter Six.

5.2 INTERVIEWEE AWARD DETAILS

Miles and Huberman (1994) indicated that the interviewee selection is crucial to the depth and richness of information obtained in an exploratory research. The objectives of this exploratory interviews as indicated in Section 4.4.3, was to explore expert opinion from successful project managers on team integration within the UK construction industry. Dainty *et. al.* (2003) remarked that the definition of a successful project manager has become controversial in today's complex construction project environment. This research, therefore, used the CIOB's Construction Manager of the Year Award (CMYA) as an objective measure of a successful project manager. This section describes the CMYA award, key roles played by the award-winning managers who were interviewed in this research and reviews the projects which these exemplary mangers successfully delivered.

5.2.1 OVERVIEW OF AWARD

The CIOB has recognised excellence in construction management through an annual awards event the "CMYA" for the past twenty eight years. The awards started as the 'Building Manager of the Year Awards' (BMYA) and evolved into CMYA after twenty six years. There are 12 categories covering managers on all construction projects from the smallest scale up to the very largest retail and commercial developments. Each category currently has a Gold and Silver medal winner (CIOB 2004). This research focussed on the top category, which is currently limited to projects over £45 million. The selection is based on the associated complexity and difficulty in integrating teams within large projects. Projects of such magnitude also contribute significantly to the total output of the construction industry (Corporate Watch 2004; Crosthwaite and Connaughton 2004; DTI 2004). Similarly, the performance of large projects has collectively become representative of the construction industry.

CMYA is open to site-based project managers with overall responsibility for the delivery of any UK construction project. The award is given to the individuals for their own project management work and it is judged by CIOB Fellows, independent construction experts and past award winners. The judges look for evidence of high

quality and innovative project management and most importantly, complete client satisfaction. The section below reviews the key roles played by exemplary project managers to merit the various awards (CIOB 2004).

5.2.2 AWARD-WINNING ROLE OF INTERVIEWEES

Winners of BMYA/CMYA are selected from a number of nominations based on the key role they played in successfully completed projects. Key roles of nine of the eleven award winners in the "large projects" category between 2000 and 2003, who agreed to take part in the exploratory interviews, are presented in this section. For reason of confidentiality the award winners are simply referred to in the text and throughout the thesis as Project Manager "X", where "X" is the identification given to the project which the managers successfully delivered. The information presented in individual project managers were gathered from the interviews and complemented by various award review articles by Cook (2000) and Sweet (2001; 2002; 2003)

Project Manager A (PMA)

PMA won the gold medal in the Building Manager of the Year Award for his management of a top-of-the-market residential block project designed by a high-profile architect. The project was the most successful undertaken by the client and it was achieved through the guile, personality and management skills PMA brought to the project team.

PMA planned disruptive work almost by the hour to cause the least disruption and he met each of the occupiers personally to explain the future activities on the site. He communicated continually with neighbours and kept them happy throughout the project. Due to the tight project schedule, PMA ensured that the design was completed at an early date. He achieved that through a day-long meeting at the start of the project involving the client, design team and cost consultant to reconsider every drawing and specification. This meant that all queries could be settled early on and that no major design reworkings were required. It also cut down the number of requests for information issued by the trade contractors. One of PMA's most endearing qualities was his sense of fun.

Project Manager B (PMB)

PMB, who won the bronze medal in the 2001 BMYA, led a construction management team to deliver an extraordinarily complex museum project on a two-acre site surrounded on all sides by the Grade 1 listed buildings. The only access was either over the top or via narrow and restricted passages through the existing buildings. One team member likened the process to building a domestic loft conversion with only the letterbox available for the delivery of materials and the removal of waste.

PMB resolved many daunting technical problems on the project and ensured that a high level of input and design development was sought from the trade contractors during the 15-month pre-contract phase so that potential difficulties and risk areas could be identified and controlled. He advised, informed, liased with and managed the expectations of all the various groups associated with the project through regular meetings to answer questions and to allay their concerns. PMA overcame a formidable array of challenges and led the construction team to meet the time and cost targets of the project.

Project Manager C (PMC)

PMC won the silver medal of the 2002 BMYA for his pivotal role and the influence he exerted on the successful outcome a very large project (area, cost and resources). PMC was responsible for managing all pre-contract and post-contract matters, as well as relations with neighbours. He brought motivation and leadership to the project, and they remained his strengths throughout the construction period.

PMC and his team arranged for the design and construction teams to be co-located on site for the first few months turning the concept design into the detail design. He introduced a number of innovations, previously unknown in site management, to the project. This resulted in high standards in quality and health and safety. PMC also played a key role in managing financial and other risks on the project which brought the final construction cost well below budget.

Project Manager D (PMD)

PMD was selected as the bronze medal winner in the 2002 BMYA because "when the wheels came off, PMD got the huge project back on the road". PMD joined the project when the works were in delay, site morale was low and frustration levels were high. Everyone knew the enormity of the task ahead and yet no one seemed able to galvanise the whole process into action.

PMD reviewed progress and the programme and re-established the critical path. The project was broken down into five smaller projects, each with its own management team and programme. At the same time, a sense of team ownership was encouraged by introducing a cluster management approach to deliver work types rather than geographical areas. PMD understood and integrated the designers' aspirations and the client's quality expectations within the severe time constraints of the programme. His strong and focused leadership throughout the period of construction ensured the successful completion of the project.

Project Manager E (PME)

PME, who won the silver medal in 2003 CMYA, successfully managed the challenges of a project which was simple in concept but extraordinarily complicated in execution. The project had a high profile and high risk but quick-thinking PME's passion for construction, motivation, technical and managerial skills enabled him to succeed so completely. He maintained a high health and safety standard and top quality site welfare facilities. PME ensured that the project neighbours were not unduly inconvenienced.

PME was initially appointed to advise on buildability and programming during the pre-contract phase. PME identified the importance of protecting the design period and, therefore, instigated design workshops to resolve the conflicts generated by the unusual shape of the structure. He encouraged the use of off-site fabrication and full-scale mock-ups to check buildability issues and to ensure that quality standards could be achieved. Early cost certainty was difficult to achieve due to the unique nature of the project but the client maintained that where additional works were needed or

design changes were necessary, PME ensured that its best interest was served at all times.

Project Manager F (PMF)

PMF won the silver medal in the 2001 BMYA for his professionalism, drive and enthusiasm which were the key elements in the success of the fixed budget public funded project. The importance of the project was not lost on PMF when he first became involved and he made it his business to understand the client's philosophy and ambitions for the project. Due to the tight budget constraints on the project, PMF ensured that the client received concise monthly reports that focused on cost forecasting rather than cost reporting. Consequently, he was able to achieve 70% cost certainty at the halfway stage of the project.

The building's use resulted in complex and dense construction and complicated logistics and programme inputs were required throughout. PMF used several innovative ideas to gain programme certainty or remove risk from the project.

Project Manager G (PMG)

PMG won the bronze medal in the 2002 BMYA for his enormous presence, professionalism and experience in delivering a flagship retails store on time for the high season festive occasion. PMG showed a steady and unwavering determination to deliver the project safely, on time and to the highest quality. He also managed to balance the interests of all parties throughout a period of continuous pressure. PMG's role was crucial to achieving programme and quality considering the project size, location and the logistic requirements.

Project Manager H (PMH)

PMH, gold medallist in the 2002 BMYA, delivered a financially constrained prestigious national stadium early by fostering fun and trust. He was able to motivate his staff at a time when redundancy was hanging over their heads and kept everyone focussed on finishing the project on time when friends and colleagues were leaving in groups. PMH kept his staff busy, socially as well as at work and made life as much fun as possible.

PMH worked hard with an inexperienced client in construction, especially on this scale, to bring the client up to speed on the process and gain their trust so that his team could deliver and integrate everyone into one team. He tried to breed a culture of openness, trust and confidence, with each party delivering what they said they would. Openness was the key again to overcoming problems on the project and everyone was involved early. PMH's construction team brought a very positive attitude to the project which spread to the whole project team. Team spirit was very high and there was willingness among everybody within the project team to get the job done properly. PMH was very proactive, firm and fair and a cheerful character.

Project Manager I (PMI)

PMI, gold medallist in the 2003 CMYA, devoted years to the massively complex city-centre redevelopment project before being recognised as its rightful leader. His first involvement with the project was to provide pre-contract and programming advice. PMI, therefore, led a small team helping the client to write a project management strategy, establish a construction method and develop the cost plan. His team was influential in convincing the local authority that the project could progress without significant interruption to the livelihoods of current occupants of the city centre.

PMI was eager for the role as a Project Manager and being a planner was both an advantage and a disadvantage. PMI had a tendency to get bogged down with particulars but on the other hand, he had the planner's eye for crucial events, so he knew where and when to bring his political skill to bear. PMI was not new to being a manager, but he admitted that managing a part of the construction process is a totally different from managing a specific project. PMI remarked that *"When you've got people above you, you can delegate up. When you don't, you got to have the answers"*.

5.2.3 PROJECTS OVERVIEW

The projects covered in the interviews included new works and refurbishment projects with contract sums up to £200m. Though the projects were executed in the UK, the companies involved have worldwide construction and professional expertise

and experience. Projects A–E were managed by delivery teams from a professional construction and project management company that works predominantly in the property and construction sectors with a turnover of £180million (in 2004) and 1500 employees. Projects F and G were managed teams from a multinational project and construction management company with over 7,500 employees and a turnover of £1.6 billion (in 2004). The teams involved in management of Projects H and I were from an international construction group with a turnover of £3.2 billion (in 2004) and over 16,000 employees worldwide, including 9,000 within the UK. Details for individual projects are provided below.

Project A

Project A involved the construction of a top-of-the market residential apartment block. The prices of units within the block started from £3 million. The £28 million project had a 22-month timetable for completion. The project involved the demolition of an 8-storey concrete framed structure situated in a conservation area. Project A was procured through a construction management approach.

Project B

Project B was a refurbishment project of a public museum building. It involved the demolition of building within an existing courtyard and the construction of a new glass and steel roof over the courtyard. Other works making up Project B were the restoration of stone facades, two levels of basements excavations and extensive reinforced concrete construction, fitting out and refurbishment of the reading room. The £78 million project was constructed in 24 months using a construction management procurement approach.

Project C

Project C was a very large office building project for a world class pharmaceutical company. It provided 10,000m² of office and ancillary space. The project comprised a 16-storey tower and three 5-storey buildings joined by a covered street containing conference facilities and a restaurant. Project C also included a separate multi-storey car park and external landscaping. The £210 million project, procured through a construction management system, was constructed in 36 months.

Project D

Project D was a large new headquarters office building for leading financial institution. The project provided a total floor space of 60,000m² and also involved the refurbishment of listed public building close to the project site. The £180 million project was procured through a construction management approach and was constructed in 36 months.

Project E

Project E was a landmark building to house the office of a mayor, an assembly and a 600-staff local authority. It is uniquely designed and architecturally stunning, both externally and internally. The construction of Project E involved over 75,000 coordinates with a margin or error to 3 decimal places. The £50 million project was constructed in 22 months using a construction management procurement system.

Project F

Project F was a lottery-funded landmark millennium project for the visual and performing arts. It is an architectural flagship which houses two main theatres and studio space for performing arts with 2400 seating capacity and 1600m² gallery spaces. The theatre foyers and gallery spaces are linked by an open ramped route. Included in Project F are a restaurant, cafes and bars. The £67 million project was constructed in 36 months using a management contract procurement system.

Project G

Project G was a new build 32,000m² flagship retail shop. The project comprised the demolition of the existing damaged retail shop and the construction of a new four floor glass curtain walled building. The new building is joined to major shopping centre by a suspended glass walkway bridge. The £92 million project was constructed in 36 month using a design and build procurement approach.

Project H

Project H was a 10,000-seater arena commissioned by a local authority through a traditional procurement system with contractor design portion and maximum guaranteed price of £35 million. The project was completed in 31 months and includes an ice ring, leisure centre, shops, dance studio and conference rooms.

Project I

Project I was a town centre redevelopment and included extensive demolition and services and road diversion. A new 5-storey mall with shops, restaurants, cinema complex, night club, new bus station and 3,000-space car park were constructed. An exiting mall was also refurbished and linked the new mall. The £131 million project, procured through a traditional system was constructed in 37 months.

Table 5.1 summarises award details and projects managed by the interviewees

Table 5.1 Interviewees award details and projects overview

Interviewee ID	Award		Project		
	Year	Medal	Procurement Method	Brief Description	Duration (months), Location and Approx. Value
Project Manager A	2000	Gold	Construction Management	Top-of-the- market residential apartment block	22, London, £28m
Project Manager B	2001	Bronze	Construction Management	Refurbishment and extension of public exhibition building	24 London £78m
Project Manager C	2002	Silver	Construction Management	16 storey 100,000m² office building	36 London £210m
Project Manager D	2002	Bronze	Construction Management	60.000m² office building and refurbishment of listed buildings	36 London £180m
Project Manager E	2003	Silver	Construction Management	Landmark building for 600 local authority staff	22 London £50m
Project Manager F	2001	Silver	JCT Management Contracting	Landmark millennium project for visual and performing arts	36 Salford £67m
Project Manager G	2000	Bronze	Design and Build	Rebuilding of 32,000m² flagship retail shop	36 Manchester £92m
Project Manager H	2002	Gold	Traditional JCT[1]	10,000 seat arena, leisure centre and associated facilities	31 Nottingham £35m
Project Manager I	2003	Gold	Traditional JCT 80	5 storey town centre development and 3,000 car parking space	37 Basingstoke £131m

1- Local Authority with Contractor designed portions and maximum guarantee price

5.3 INTERVIEW RESULTS AND ANALYSIS

Interview data gathered from the exploratory semi-structured interview at this stage of the research were recorded. To enable any further manipulations and conduct and robust analysis, the data were transcribed verbatim. The transcribed data were then sorted out into two main themes; project and delivery team issues (Lofland and Lofland 1995; Miles and Huberman 1994; Ritchie et al. 2003; Ritchie and Spencer 2002). Project issues covered responses or data that were related to the overall delivery of the project. Delivery team issues were restricted responses that related to the team with the overall responsible for the delivery of the project. This section presents the results of the interviews. The section is divided into two subjections, one dealing with project issues and the other with delivery team issues.

Using an adapted form of "framework analysis" presented in Section 4.4.5, in-case and cross-case assessment of practices towards integration was carried out. The assessment was made to determine the extent of integration within each delivery team using the team integration matrix discussed in Section 4.5.4. The level of teamwork within each delivery team was also assessed using the team effectiveness matrix discussed in Section 3.4.4. For easy identification and systemic presentation of data, prefix codes listed in Table 5.2 were used.

Table 5.2 Interview quotation code prefix details

Interviewee ID	Code prefix
Project Manager A	PMA-00-G
Project Manager B	PMB-01-B
Project Manager C	PMC-02-S
Project Manager D	PMD-02-B
Project Manager E	PME-03-S
Project Manager F	PMF-01-S
Project Manager G	PMG-00-B
Project Manager H	PMH-02-G
Project Manager I	PMI-03-G

5.3.1 PROJECT ISSUES

Interview data on project issues are summarised in Tables 5.3. The data were sorted into main themes, within the project context, identified from the verbatim transcriptions (Ritchie and Spencer 2002). The table also include the procurement option used for the project. The issues identified are detailed below.

Procurement option

These were responses that related to the procurement system (detailed discussion of available systems is in Section 2.3) used in delivering the project.

Project challenges

These were responses that highlighted the significant and unique challenges faced by the interviewees during the execution of their projects. The challenges related to the overall project and included both internal and external issues that impacted directly or indirectly on the construction and management of the project.

Delivery strategy

These were interviewee responses on the overall strategy adopted to ensure that the project was delivered successfully. The responses included technical and managerial strategies that were adopted in the context of the challenges faced by the project team.

Good project practices

These were responses that highlighted practices, within the context of the project team, which contributed significantly to the success of the project. The responses collectively represented good practices that the interviewees were willing to apply or use in the management of projects in future.

Project success assessment

These responses related to the systems, mechanisms and yardsticks used by the interviewees to assess the success of the project that they had completed. They were non-contractual but gave an indication of how the interviewees viewed and determined project success.

Table 5.3 Interview results on project issues.

	Project A	Project B	Project C	Project D	Project E	Project F	Project G	Project H	Project I
Procurement option.	Construction management *(PMA-00-G-01)*	Construction Management *(PMB-01-B-01)*	Construction management *(PMC-02-S-02)*	Construction management *(PMD-02-B-01)*	Construction management *(PME-03-S-02)*	JCT Management Contracting *(PMF-01-S-02).*	Design and Build *(PMG-01-B-02)*	JCT local Authority with Contractor design portions and guaranteed Maximum price supplement *(PMH-02-G-02)*	Traditional JCT 80 *(PMI-03-G-02,03)*
Project challenges.	Location of the project. Nature of work involved. Tight completion schedule with significant financial implications. *(PMA-00-G-02)*	Location of the project. Time of construction activities. *(PMB-01-B-02)*	Client changes. Project location. Local residence associations and building control office requirements. Project programme recovery. *(PMC-02-S-02,03)*	Project location. Complexity and scale of work. Programme difficulty. *(PMD-02-B-01)*	Project location. Complex shape of building. Programme and cost certainty *(PME-03-S-02, 05,06)*	Project location. Uncertain nature of ground. Number of subcontracts. Project delivery time. *(PMF-01-S-02).*	Project location. Complexity of logistic requirements. Materials procurement. Tight project deadline. *(PMG-01-B-02,03)*	Project location. Political profile of project. Stakeholders (Public) demands. Inadequate provisional sum. *(PMH-02-G-02)*	Scale and scope of project. Logistic requirements. Construction and handover sequence. Liasing with services and utilities providers *(PMI-03-G-03,04)*
Project delivery strategy.	Collectively detect and resolve potential project conflicts early on throughout the duration of project. *(PMA-00-G-05,09)*	Pre-plan design and sequencing of work to simplify construction and minimise disruption to building use. *(PMB-01-B-02)*	Creation of a common project team culture through behaviour management to focus on project goals. *(PMC-02-S-02,03)*	Breaking up the overall project into smaller manageable projects and encouraging sectional ownership. *(PMD-02-B-03)*	Appreciate the difficulties of the project, allow adequate design period and closely control critical areas. *(PME-03-S-02)*	Early planning and preparation to improve works and subcontractors interface on site. *(PMF-01-S-02).*	Break project into smaller and manageable clusters and engender performance through competition *(PMG-01-B-10)*	Create a team of key personnel to deal with all issues on the project in a collective and centralised manner. *(PMH-02-G-06,07)*	Split overall projects into complete functional sections to focus teams on delivering sections. *(PMI-03-G-12,13)*
Key practices within the project.	Keeping client informed. Proposal of alternative solution for Discussion with clients. Good relationship and communication with project neighbours. Making client satisfaction a priority. *(PMA-00-G-05,11)*	Pre-construction planning of the project. Robust change control system. Balancing good relationship and competition. Keeping the client informed. Robust team structure to facilitate communication. *(PMB-01-B-03,08,21,27)*	Involvement of all project stakeholders. Change of traditional project drivers. Proactive working attitude. Breakdown of hierarchy. Reduction of bureaucracy. Early project final account *(PMC-02-S-06,08,11)*	Client involvement. Non-confrontational working attitudes. Good relationships among teams. Good working relations with stakeholders Good inter-team interface *(PMD-02-B-04,15,22)*	Sufficient design lead time. Discussion workshop on design and programme. Collective responsibility and equal treatment of all teams. Tuning in to client's expectation and aspiration *(PME-03-S-03,10)*	Selection of capable package contractor with right financial comforts. Proactive attitude design and construction issues. Non-adversarial relationships. Collective resolution of problems. *(PME-03-S-02,13)*	Open dialogue to engender good working relationships. Integrated approach to design, procurement and construction Centralised coordination of services. Proactive resolution of problem *(PMG-01-B-02,03,04)*	All inclusive centralise decision-making and communication Treatment of contractor as a professional advisor Informed client and project stakeholders *(PMH-02-G-05,07)*	Early formation of relationships with business principals Good understanding of approach and constraints to construction works. All inclusive decision making process. Acceptance of inputs from all parties *(PMI-03-G-05,17,21)*
Project success assessment.	Client satisfaction from feedback survey. Returned work from client *(PMA-00-G-07)*	Client satisfaction survey using key performance indicators. Aesthetically pleasing building completed to targets. *(PMB-01-B-,12,13,32)*	Key performance indicators. Last planning device. Client and project. team satisfaction. Meeting all project benchmarks. *(PMC-02-S-04,31)*	Time, cost and quality benchmarks. Aesthetically impressive project. Satisfied client and neighbours. Provision of learning experience and spin offs. *(PMD-02-B-07,35)*	Key performance indicators. Client satisfaction feedback. Project team members satisfaction. *(PME-03-S-14,15,,22)*	Performance appraisal system. Satisfied client, design team and other stakeholders. Client appreciation Product quality. Sense of pride *(PME-03-S-20,21)*	Internally generated performance appraisal system based on predetermined criteria. *(PMG-01-B-16)*	Time, cost and quality benchmarks. Satisfied client and project team. Repeat business with Client. *(PMH-02-G-09,14)*	Use of targets to measure programme performance Feedback from subcontractors to measure cost. *(PMI-03-G-15)*

5.3.2 DELIVERY TEAM ISSUES

Having determined the key issues from interviewees responses that related to the overall project in Section 5.3.1, the interview data were further sorted out into issues that directly related to the team responsible for the design and construction, the project delivery team (defined in Sections 1.1 and 1.4). The results are summarised in Table 5.4. The main issues resulting from the analysis are outlined below:

Team formation

Issues grouped under the above theme were responses from interviewees on when they joined or were involved with the team. How the various team were formed are also captured under this theme.

Team member selection strategy

Responses captured under the above theme were the opinions of interviewees on the strategy they would like or are more likely to adopt in selecting members for their teams. The responses are presented in order of preference.

Team dynamics

Membership changes that occurred during the execution of the project are grouped under the above theme. It is a description of the composition of the project delivery team and when and why membership changes were made

Good team practices

Responses grouped under the above theme covered best approaches used by interviewees in managing their teams. In the opinion of the interviewees, these practices were largely responsible for the level of effectiveness and success they achieved within the various delivery teams that they managed.

Success drivers

In the opinion of the interviewees, their teams' success could be attributed to issues grouped under the above theme. These were the main source of motivation and driving force behind the success achieved within and by the teams that the interviewees managed.

Table 5.4 Interview results on delivery team issues

	Project A	Project B	Project C	Project D	Project E	Project F	Project G	Project H	Project I
Team formation	- PMA was involved from the start of the project - Members from previous project. *(PMA-00-G-02,03)*	- PMB involvement started 15 months before the start of the project. - Members from previous project. *(PMB-01-B-02)*	- PMC led the team the start of project - A few core members from previous project. - Additional young and new staff . *(PMC-02-S-13,14)*	- PMD joined the project at the superstructure level. - Used members of the existing team on site. *(PMD-02-B-02,18)*	- PME was part of the delivery team from the start of the project. - Members from a previous project. *(PME-03-S-02)*	- PMF formed the delivery team 6 months before works on site. - Best suited existing staff. *(PMF-01-S-02,04)*	- PMG got involved 9 months before project start date. - Available personnel with requite skill who would benefit from the project. *(PMG-01-B-02)*	- PMH was involved from the start of the project. - Members from previous project. - New staff. *(PMH-02-G-04)*	- PMI was involved 2 years before the start as a planning consultant. - Members from previous project. *(PMI-03-G-02,03)*
Member selection strategy	- Availability of personnel. - Personal knowledge. - Compatibility with other team members. *(PMA-00-G-12)*	- Availability of personnel. - Suitability to the needs of team. - Personal references. - Prospects of retention. *(PMB-01-B-29)*	- Personal interviews & recommendation - Willingness of young and new staff for challenges. - Use of experienced staff with desire to learn more *(PMC-02-S-0)*	- Personnel availability. - Individual skill or expertise. - Personal knowledge. *(PMD-02-B-18,19)*	- Personal knowledge and trust. - Like minded with requisite skill. - Similar objective and drive. *(PME-03-S-03)*	- Availability of personnel. - Skills that match the project requirements. - Personal knowledge. *(PMF-01-S-04,07)*	- Personal preference from available personnel - Technical capability. - Easy to get along with. *(PMG-01-B-12,13)*	- Availability of personnel with the right skill. - Potential to blend into the team. *(PMH-02-G-04,05)*	- A balance of technical and managerial capabilities. - Availability of requisite skilled personnel. *(PMI-03-G-19)*
Team dynamics	- Maintained a core team throughout the duration of the project. - Additions to lower management on need basis. *(PMA-00-G-06)*	- Started with a small strategic team. - Maintained a core throughout the project. - Added and removed as needed. *(PMB-01-B-06,23,24)*	- People generally moved in and out of the team based on job requirements and extent of involvement on the project. *(PMC-02-S-26)*	- Performing members were maintained throughout the project. - New members were added on to inject drive. *(PMD-02-B-21,22)*	- Maintained a core team throughout the project. - Fresh pair of eyes toward the end of the project. *(PME-03-S-30)*	- Started with a few planning staff. - Maintained a core team. - Brought in specialist skill when required. *(PMF-01-S-05,07)*	- Maintained the same management team and 80 to 90% of staff. - Added very few specialist. *(PMG-01-B-14,15)*	- Maintained same management team throughout. - Various skilled personnel movement based on project stage and requirements. *(PMH-02-G-08)*	- Maintained a core team throughout the project. - Added needed expertise and moved others. *(PMI-03-G-23,26)*
Key team practices	- Early team brainstorming to identify potential project risks. - Respect for all members. - Strong and all involving leadership - Collective responsibility. - Good communication. - Early assumption of project ownership - Relaxed working atmosphere. - Fun. *(PMA-00-G-04,05,08,11)*	- Giving members sense of ownership and satisfaction. - Structured team meeting with set objectives. - Integrated approach to working. - Replacing fault finding with problem solving. - Collective involvement. - Structured communication. - Transparency. - Social outings/fun. *(PMB-01-B-08,17,33)*	- Continuous staff development. - Removal of treat to career progression. - Empowerment within realms of responsibilities. - Leadership by example. - Management through technical and social experiences. - Positive support and trust. - Managing behaviour patterns. - Fun. *(PMC-02-S-10,15,17,25)*	- Ownership and management responsibility for section of work. - Focus on joint resolution of problems. - Non-financial reward scheme. - Confidence in programme of works. - Engendering high team morale. - Good relations and fun. *(PMD-02-B-23,24,26)0*	- Strong leadership and competent personnel. - Transparency within the team. - Individual acceptance of errors but joint resolution. - Collective checking of project details. - Stress and tension management through social functions. - Brainstorm away day workshop on expectations and no-go areas. *(PME-03-S-03,04,15,16)*	- Balanced technical and managerial abilities. - Motivation to give extra. - Positive belief in team's ability. - Sense of ownership and togetherness. - Detection of mistake but no blaming. - Reward through appreciation and praise. - Proactive and helpful working attitude. *(PMF-01-S-02,07,11,14)*	- Early resolution of personal all problems. - Engendering trust to facilitate constructive criticisms. - People management. - Positive attitude. - Availability of project information. - Co-location of team. - Open dialogue and easy access to management. - Early formation of relationships. *(PMG-01-B-02)*	- Strong and firm leadership that dealt with issues practically. - Clarification of duties and responsibilities. - Creation of discussion forum. - Honesty, trsut and integrity with the team. - Focus and direction towards project objective - Valuing the team *(PMH-02-G-07,10,15)*	- Structured line of communication due to scale of project. - Reliance on formal lines of communication. - Good document control system. - More regular meetings to assess progress. - Focussing the team on job requirements. - Creation of a budget for social functions. - Sectional ownership of project by teams. *(PMI-03-G-13,20,25)*
Success drivers	- Desire to achieve set target. - Collective problem resolution. *(PMA-00-G-09)*	- Maintain high client satisfaction rating from previous projects - Existence of no blame culture *(PMB-01-B-17,18)*	- Achieving high performance standards. - Willingness to learn and sharing of experience. *(PMC-02-S-15,22,24)*	- Focus on manageable section of work. - Winning client's confidence in team's ability to deliver. *(PMD-02-B-03,04)*	- Desire to complete a complex project. - General enthusiasm and sense of pride from achievements. *(PME-03-S-04,22)*	- Drawing up of an achievable programme of works. - Collective sense of achievement and responsibility. *(PMF-01-S-02,21,22)*	- Prestige of project - Financial implications of failure *(PMG-01-B-05,08)*	- High profile nature of project. - Opportunity to improve professionally. *(PMH-02-G-15,16)*	- The presence of key persons committed to making things happen. - Ownership of section of work. - Team spirit. *(PMI-03-G-23,24,25)*

5.3.3 INTEGRATION PRACTICES

The interview data and good project and team practices from Tables 5.3 and 5.4 were mapped unto the team integration matrix discussed in Section 3.5.4. This was to assess the extent of integration within the various delivery team managed by the interviewees. In this assessment, the six key dimensions of integration were used as the major themes to allow the application of the "framework" method of analysis. The following legend (see Table 3.7 in Section 3.5.4 on page 116) was used to indicate the extent of integration in the assessment results presented in Table 5.6:

- F: Full integration
- P: Partial integration
- N: No integration or existence of fragmentation

Table 5.5 Team integration assessment

		Dimensions of integration (from literature synthesis)					
		Single team focus and objectives	Seamless operation without boundaries	Unrestricted cross-sharing of information	Creation of single and co-located team	Equitable relationships, opportunities & respect for all	"No blame" culture within team
Project ID	A	*P*	*N*	*P*	*P*	*F*	*F*
	B	*P*	*N*	*P*	*P*	*F*	*F*
	C	*P*	*N*	*N*	*P*	*F*	*P*
	D	*P*	*N*	*P*	*P*	*P*	*F*
	E	*F*	*P*	*F*	*P*	*F*	*F*
	F	*F*	*N*	*P*	*P*	*P*	*P*
	G	*F*	*P*	*F*	*F*	*F*	*F*
	H	*P*	*N*	*P*	*P*	*F*	*P*
	I	*P*	*N*	*P*	*P*	*P*	*P*

5.3.4 TEAMWORK EFFECTIVENESS

Integration has been suggested as a means of improving the fragmentation within the project delivery team (Achieving Excellence in Construction 2003; Crane 2002; Egan 2002; Lennard et al. 2002). A fully integrated team is, therefore, expected to show a high level of teamwork effectiveness that will lead to an improvement in project delivery performance (Achieving Excellence in Construction 2003; Crane 2002; Egan 2002; Lennard et al. 2002; Moore and Dainty 2001; Payne et al. 2003; Strategic Forum for Construction 2003; Vincent and Kirkpatrick 1995; Vyse 2001).

Using a similar methodology outlined in Section 5.3.3, the interview data and good project and team practices from Tables 5.3 and 5.4 were mapped unto the effective teamwork assessment matrix discussed in Section 3.4.4. The objective was to determine the level of teamwork effectiveness within each delivery team managed by the award-wining construction project managers (interviewees). The six key elements matrix were used as major themes, which conform to the "framework" method of analysis discussed in Section 4.4.5. The scale of progression towards best practice in teamwork effectiveness is shown in Figure 5.1. The various levels, L0 to L4, are explained in Table 3.5 (page 106) in Section 3.4.4.

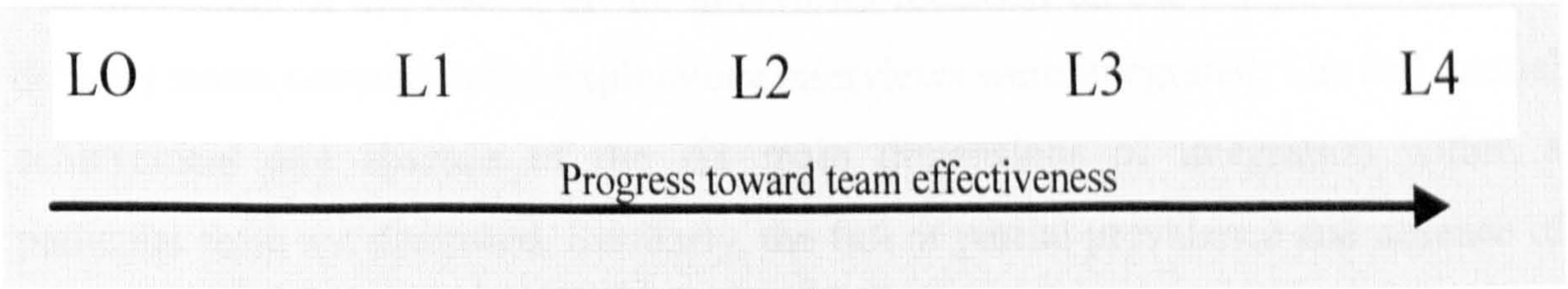

Figure 5.1 Scale of progression towards effective teamwork

Using the verbatim transcriptions from the interviews and good project and team practices from Tables 5.3 and 5.4, practices within each delivery team towards effective teamwork were mapped unto the various level of progress towards best practice described in the matrix using the scale in Figure 5.1. The results are presented in Table 5.5.

Table 5.6 Effective teamwork assessment

		Key elements of effective teamwork					
		Team Identity	**Shared vision**	**Communication**	**Collaboration and participation**	**Issue negotiation and resolution**	**Reflection and self-assessment**
Project ID	**A**	*L4*	*L2*	*L3*	*L2*	*L3*	*L2*
	B	*L3*	*L2*	*L3*	*L4*	*L3*	*L2*
	C	*L3*	*L3*	*L2*	*L2*	*L3*	*L4*
	D	*L4*	*L2*	*L2*	*L2*	*L4*	*L2*
	E	*L4*	*L3*	*L3*	*L4*	*L3*	*L2*
	F	*L3*	*L2*	*L3*	*L3*	*L2*	*L2*
	G	*L4*	*L3*	*L3*	*L4*	*L3*	*L2*
	H	*L3*	*L2*	*L3*	*L4*	*L3*	*L2*
	I	*L3*	*L2*	*L3*	*L3*	*L3*	*L2*

5.4 DISCUSSION OF RESULTS

The discussion of the results of the interviews focussed on the extent to which the delivery teams covered in the exploratory interviews were integrated. The full, partial achievement and absence of the six main dimensions of integration within a particular team are discussed. Similarly, the full or partial prevalence and absence of any of the dimensions across the nine project delivery teams covered in the interviews are also highlighted (Lewis and Ritchie 2003; Miles and Huberman 1994; Ritchie et al. 2003; Ritchie and Spencer 2002). A further discussion within the section sets out to provide an empirical, rather than theoretical evidence, to highlight the influence or the impact of integration on teamwork. This is to strengthen the case put forward for integration as a means of improving the effectiveness of teamwork (Lennard et al. 2002; Payne et al. 2003; Rabey 2003). The objective is to determine whether integration is necessary for improving the effectiveness of teamwork.

5.4.1. TEAM INTEGRATION PRACTICES

The integration matrix, presented in Table 3.7, highlighted practices that indicated full, partial or absence of integration. The matrix illustrates the practical manifestation of the alignment of practices with key dimensions of team integration identified from past research (see Table 3.6). A summary of the interview results presented in Table 5.6 are, therefore, practices within the project delivery teams managed by award-winning project managers which appeared to facilitate their integration.

Most of the project teams (six out of nine) struggled to achieve an agreed single focus and set of objectives, an espoused requirement for team integration (Baiden et al. 2003; Bromley et al. 2003; Cornick and Mather 1999; Love and Gunasekaran 1998; Moore and Dainty 1999; Strategic Forum for Construction 2003; Vyse 2001). Though the need for consensus was acknowledged in the six projects, the members often felt constrained by their own professional and organisational expectations. This is consistent with the findings of Moore and Dainty (2001) on the need to develop a homogeneous project culture to overcome professional segregation. Teams in Projects E, F and G were totally focussed on a single project objective. The members in these teams had the same focus and collectively worked as a group to achieve the objectives of the project. Team members in Projects A, B, C, H and I pursued individual objectives that were, in principle, not detrimental to the overall project goal.

All the project teams were unable to operate seamlessly due to the continued operation of their members within their boundaries of organisational identity or affiliation (see Table 5.6). The only attempts at seamless project team operations were in Projects E and G. In these two projects, the various teams made significant efforts at collaborating with each other. This is indicative of the industry struggling to overcome cultural attitudes even when they are negatively impacting on its performance. Vyse (2001) and the Strategic Forum (2003) both pointed out that for effective integration to be fully realised, individual team identities must give way to a new single "integrated" team in which defined organisational boundaries do not exist. However, given that all of the projects were deemed to be successful, the

extent to which seamless operation is a necessary condition for project success appears questionable. With the exception of project G, all the Project teams were not able to form a new single team although they operated within a single office location. They remained as individual sub-teams within their confined work spaces but co-located with others.

For teams to be effectively integrated, project information should be available and accessible to all parties to allow informed decision-making (Bromley et al. 2003; Cornick and Mather 1999; Evbuomwan and Anumba 1998; Moore and Dainty 1999; Vyse 2001). In Projects A, E, G and H for example, design drawings were made available to the construction team for comments on buildability. These comments were then taken into account by the commercial team during deliberations in relation to cost issues. Other specialist teams were also given the opportunity to provide advice at the early stage of the project, but very rarely were all specialist functions brought together to consider issues concurrently with each other. In Projects B, E and G, the managers operated an open and transparent system with easy access to information. The project teams consequently had an improved ability.

All of the interviewed construction managers expressed their ambitions towards developing more continuity of work and long-term relationships with key clients in order to maintain a competitive advantage. This supports the key principles of the "Integration Toolkit" (2003), which is to sustain long-term working relationships within the industry. Six out of the nine project teams were formed before work started on site and focused on continued work with the client. That contributed significantly to the equal respect for all the teams involved in the projects. The organisational structures allowed direct access to top management as recommended by Anumba et al. (2002). The structures, therefore, allowed direct lines of communication across organisational boundaries. As a result, inputs from the various professions were easily recognised because they were not issued through a long chain of commands. The level of professional recognition for all teams was enhanced as the project team structure clearly showed the contributions made by the various professional towards the success of the team or project. The resulting impact was that the teams looked for solutions to problems rather than trying to blame one another

(see Table 5.6). Adversarial relationships were subsequently replaced with co-operation and early identification of potential problems which were either avoidance or resolved jointly. This approach reflects the principles of, a collaborative working tool, known as "FUSION". The tool seeks to outline a numbers of issues and measures that need to be addressed by the project team if the various members are to work more collaboratively (Vyse 2001).

To summarise, the project teams surveyed exhibited the following with respect to team integration.

- They worked towards achieving a single team focus and common project objectives but did not operate seamlessly. The various members within the project team continued to work disjointedly within their individual organisations. They were not able to form a new single team that was co-located.

- They created a project culture where all participants worked towards a common project goal and had respect for each member of the team through good relationships formed at the early stages of the project. This led to high levels of trust and removal of adversarial attitudes and "no blame" cultures which engendered joint resolution of problems.

The results show that none of the project teams were totally fragmented or integrated. The various members of the project team were not able to operate seamlessly as a single team. They all showed varying levels of partial integration. Teams on Projects E and G exhibited the highest degree of integration in relations to the dimensions explored. A moderate level was found in Project B. The remainder of the project teams exhibited practices that indicated they were partially integrated.

The results uncover the challenges inherent to improving collaborative working. The practices within the team highlight issues such as professional alignment, attitudes and relationships, all of which were identified by Evbuomwan and Anumba (1998) and Moore and Dainty (2001) as those that contribute to the successful integration of teams. These findings do not necessarily undermine the importance of integrated

teams, but indicate that even the very best examples in the industry still fall short of the integration expectations set out in the ''Accelerating Change'' report (2002).

5.4.2 INFLUENCE OF PROCUREMENT SYSTEM ON INTEGRATION

The discussion of the results in the Section 5.4.1 focused on how practices within the construction project team helped to integrate the activities of the various participants. These practices took place within the context of the procurement approach used for the projects. This section discusses the influences of these approaches on practices towards integration of the project delivery team.

As shown in Table 5.6, the results of the interviews confirm that the team in Project G, which was procured through the Design and Build approach (see Section 2.3.2), had the highest level of integration. The team did not, however, provide totally seamless project delivery operations with a complete absence of professional and organisational boundaries. Additional effort would have been required to fully break down professional and organisational barriers. Common project goals and objectives were still resolutely viewed from organisational perspectives, rather than from collective project standpoints. Combining expertise from different companies to form a new organisation remained a challenge on the project because traditional attitudes and professional procedures prevailed, as highlighted by Jefferies et al (1999). Thus, the results confirm earlier findings by Moore and Dainty (2001), that the achievement of expected results by Design and Build project teams can hide the actual attainment of integration and the performance of a project team.

The team in Project E, procured through Construction Management (see Section 2.3.3.2), displayed many characteristics of integration. This was attributed to the method of procurement, which enabled the Construction Manager to become the focal point of construction activities. This brought together the Design and the Construction Teams in the product delivery process and the Client Team in the management of the product, which according to Alshawi and Faraj (2002) is a primary benefit of integration. The complicated nature of Project E was such that lack of cooperation from any of the project team members would have had a profound negative impact on the success of the endeavour. There were, therefore,

consultations, crosschecking and the provision of advice on buildability and cost on every aspect of the construction work. This encouraged the project team together to work in an integrated manner as possible. The design and construction teams on the project were co-located, which increased collaboration through an improved information flow. The teams, however, maintained their organisational identities and boundaries. This was due to the fact that the procurement approach did not necessarily call for the creation of a single co-located team although collective working was encouraged on the project (see Table 3.7).

The teams in Projects 8 and 9 had both been procured through the traditional procurement route (see Section 2.3.1), which has traditionally led to fragmentation of the parties involved. They were not fully fragmented but showed low level of integration (Anumba et al. 2002; Evbuomwan and Anumba 1998; Vyse 2001). Project 8, for example, had elements of the works designed and built by the Contractor thus providing an avenue for integrated team efforts. In Project I, the Construction Team was involved in the initial planning of the works and had the opportunity to contribute to certain elements of the design process. The access to the Client and Design Team was crucial to bringing all the teams together. The complicated nature and the numerous components of Project H encouraged the parties to work in a collaborative and constructive way.

Analysis of the influence of procurement route on integration practices demonstrated the following.

- Design and Build procurement system provides the best opportunities and more conducive environments for project teams to work together effectively. The system places more emphasis on the formation of a single team with the dual responsibilities for design and construction.

- On the projects adopting Construction Management approach, the project delivery teams were able to work together better because the pivotal role of the Construction Management contractor was fully exploited. Integration was also enhanced where the various parties were involved at an early stage of the project.

- In traditional procurement arrangements, teamwork was better achieved through repeated work. Modifications, such as contractor-designed portions helped to improve the level of teamwork among the client, design and construction teams. Thus using the contractor as a professional advisor rather than the party that merely takes instructions from the design team also contributed to improve project team relationships and led to better teamwork. This comes from the recognition accorded the contractor and a gradual shift from the standpoint of being at the receiving end to an active contributor or participant in the project team.

5.4.3 INTEGRATION AND TEAMWORK

Integration has been suggested by past research as a demonstrable means of improving the effectiveness of teamwork to lead the expected improvement in the performance of the project delivery team (Achieving Excellence in Construction 2003; Betts et al. 1995; Constructing Excellence 2004a; Conti and Kleiner 1997; Davies 1995; DBF 2000; Egan 2002; Payne et al. 2003; Stot and Walker 1995; Strategic Forum for Construction 2003). Empirical evidence in linking the two concepts has, however, not received much attention. This research, therefore, provides a means of determining the extent of impact of integration on teamwork. Tables 5.5 and Table 5.6 contain data from the same source (interviews of award-winning Construction Project Managers presented in Sections 5.2 and 5.3). The tables are comparable and provide a robust means of identifying the impact of integration (Table 5.5) on the effectiveness of teamwork (Table 5.6)

The results from Table 5.6 show that ownership of problem and joint acceptance and responsibility for resolving problems were handled very well by all the teams. They all struggled with member roles review on a regular basis to identified likely impacts. They generally acknowledged the roles of the various members of the team but did not review their responsibilities from time to time. This underlines the lack of a robust system of team performance measurement. The levels of effectiveness of the other elements of the teamwork matrix (Table 3.5) were very good. This meant that the teams communicated well and worked towards a common project objective. They also approached these issues in an integrated manner and resolved their differences

openly as shown in the results of the integration matrix in Table 5.5. Collectively, the results show that teams managed by the interviewees, performed the various individual activities and functions that together represented effective teamwork very well.

Practices within the interviewed project delivery teams pointed towards very good levels of effectiveness of teamwork with Projects E and G having the highest levels of effectiveness. These projects were also the most integrated, according to the practices adopted within the teams, as discussed earlier in Section 5.4.1. The effectiveness of teamwork in Projects A, B, C D, H and I were very much the same. The team in Project F had the least effective synergetic process of working together. Results from Section 5.4.1, however, indicated that the team in Project F was as partially integrated as the teams in Projects A, C, D, H and I. The low level of teamwork effectiveness in Project F could be traced back to Table 5.3 which highlighted the handling of the number of subcontractors as a major project challenge. At the core of the concept of teamwork within the construction project environment context, as discussed in Section 3.4, is the synergetic process of bringing different skill requirements together. This increases with increasing difficulty in managing the number of different skill that are involved in a project (Constructing Excellence 2004b; Dickinson and McIntyre 1997; Drew and Coulin-Thomas 1996; Hayes 2002; Ingram et al. 1997; Kirchmann and Hauschild 2001).

The results from Tables 5.5 and 5.6 and the discussions in Section 5.4.2 and above indicate that integration is useful for improving the effectiveness of teamwork. Practices that meet the various requirements of integration either complement or increase the likelihood of fulfilling the key elements of effective teamwork. This research, therefore, supports the position that integration leads to improvement in teamwork effectiveness (Egan 2002; Strategic Forum for Construction 2003; Vyse 2001). The results also show that teams that are integrated to different extents can have the same or similar levels of effectiveness in how they work together. This can be interpreted to mean that integration is not a prerequisite for improved teamwork effectiveness. It does not also imply that the absence of integration means no teamwork. The results only reinforces that integration is a desirable or helpful and

will lead to improved teamwork (Egan 2002; Lennard et al. 2002; Strategic Forum for Construction 2003; Vyse 2001; White 2002). This position is sufficient to support the argument put forward by past research that the performance of the project delivery team can be improved through integration.

5.5 SUMMARY

This chapter presented the results of exploratory interviews conducted with nine out of eleven CIOB award-winning construction project from 2000 to 2003. The results were grouped into project issues and delivery team issues using data from verbatim transcriptions of the interviews. The results were then mapped unto the integration matrix to determine the extent of integration within the team. The same data was used to determine the level of teamwork effectiveness within the various project delivery teams using the teamwork effectiveness matrix. This provided empirical evidence on the impact of integration on teamwork.

The results of the interview indicated that the extent of integration is dependent on the practices within the team and is influenced by the procurement system used in delivering the project. Integration helped in improving the effectives of teamwork although partially integrated team could have effective teams. Teams operated largely as individual competent units within their own organisations but had an aspiration to work together. The level of collaborative and integrated working was improved significantly through the early formation of relationships. This indicates the importance and role of the concept of social capital in improving integration within the construction project environment. Teams integrated better when they were able to work without any adversarial attitudes and consequently had "no blame" cultures. Design and Build procurement offered the most conducive environment for teams to integrate and worked collaboratively. This was due to the central role and the responsibility of the Design and Build contractor to bring the various teams together as a single unit.

The discussion of results in Section 5.4.1 indicated that construction project delivery teams attempting to integrate still face considerable challenges. To reduce or eliminates these challenges calls for further investigations within the most conducive

project environment in which integrated practices are expected to be at their very best in order to highlight the issues that need to be addressed and the practices that have to be adopted for improved integration.

The chapter identified factors that influenced integration within exemplary delivery teams in completed projects. The study was exploratory and data were gathered from interviews with award-winning construction managers who managed the delivery teams within completed projects. It was, however, an important step to identifying the issues that need further investigation with a life construction project environment. The next chapter uses a case study approach to conduct in-depth empirical investigation of integration practices within the selected live delivery teams under the leadership of the award-wining managers who participated in the exploratory interviews.

CHAPTER SIX – INTEGRATION PRACTICES WITHIN LIVE PROJECT TEAMS

6.1 INTRODUCTION

The aspiration of the project delivery teams within the UK Construction Industry to integrate and improve the delivery performance of projects was highlighted in Chapter One. The chapter also presented the justification and the key questions for the research into team integration. Chapters Two and Three reviewed relevant literature on the performance of the UK construction industry and the concepts of team, teamwork and integration. Appropriate research methodology for collecting and analysing data to address the research questions were discussed and selected in Chapter Four. The resulting research process was presented in Section 4.3.

The preceeding chapter (Five) presented the first stage of the research process. Exploratory interviews were conducted among leading construction project managers to identify good integration practices. The chapter also presented empirical evidence on the impact of integration on teamwork to justify the call for integration as a means of improving teamwork required for improved project delivery. The results from the interviews provided the basis for the conduct of the case studies presented in this chapter.

This chapter presents the findings from the case studies conducted to explore integration practices within the project delivery teams. The background information of the projects that served as cases are described. The structure of the delivery teams, comprising the design, construction and management teams are then highlighted in the chapter. The sources from which data on specific issues of team integration were collected are described. The main findings, on case to case basis, based on data collected through observations, interviews and documentation are then presented. The chapter concludes with a summary of practices within individual cases on team integration.

6.2 CASE 1

6.2.1 PROJECT BACKGROUND

Case 1 was a £120million redevelopment of a major broadcasting centre. The project started in January 2003 and is scheduled for completion in September 2008. The project was designed to be a quality product through the design of its aesthetic appeal, transfer structure and bespoke studios. Case 1 had key construction challenges such as off-site pre-fabrication, flat pack studio floor and elevational co-ordination. The site works was at an advanced stage at the time of the study and had over 50 on-site personnel with management responsibilities for delivering the project.

Case 1 was delivered through a Special Purpose Vehicle (SPV) made up of the Media house (15%), Property Management Company (10%) and a Financial Institution (75%). The SPV acted as the client of the project which was procured through a Novated Design and Build (see Section 2.3.2.2) arrangement. Project design was won in competition by an architectural organisation that was later novated to a Design and Build construction company. The client retained a team of consultants to supervise the project. The contractual format of Case 1 is shown in Figure 6.1 below.

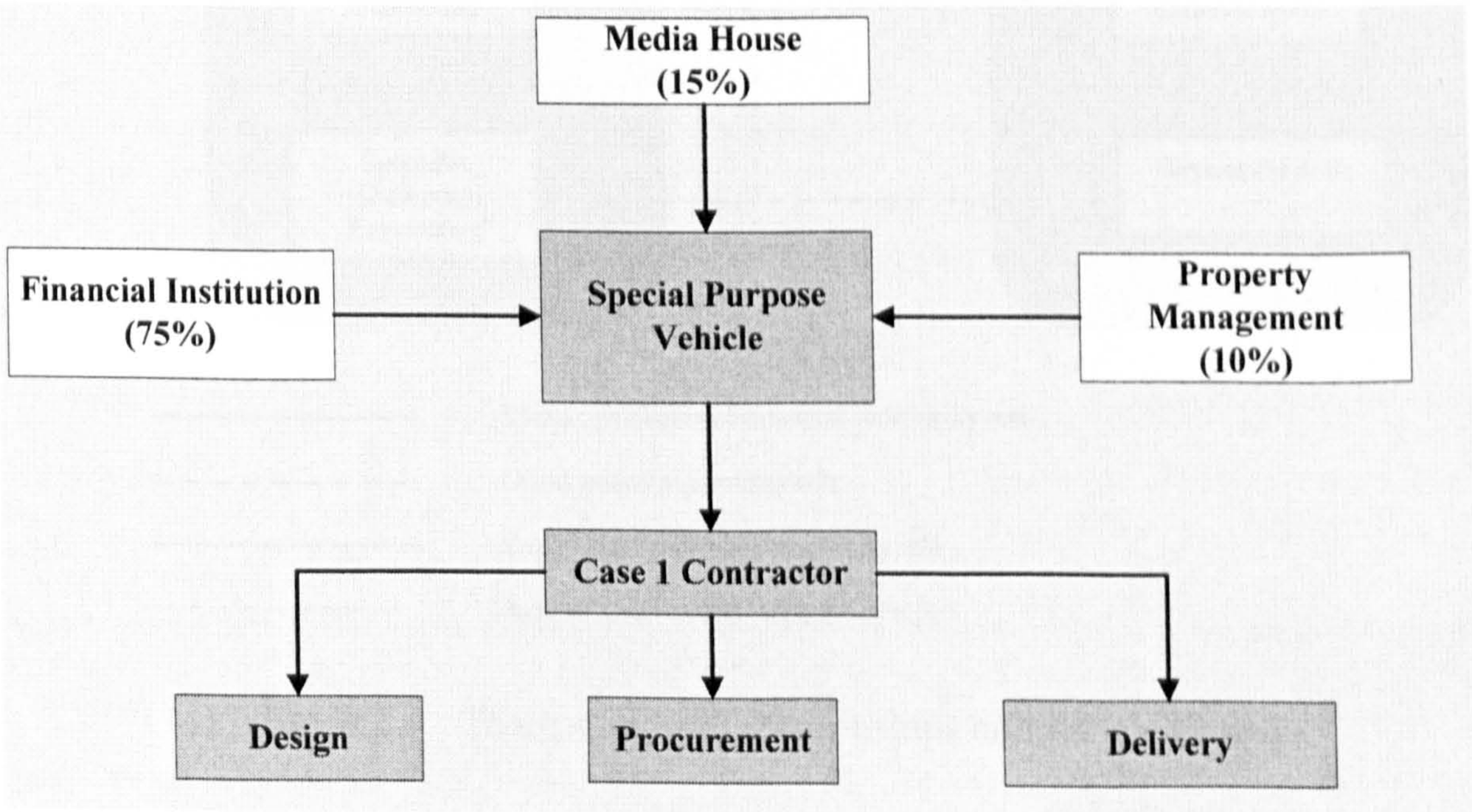

Figure 6.1 Contractual format – Case 1

6.2.2 DELIVERY TEAM STRUCTURE

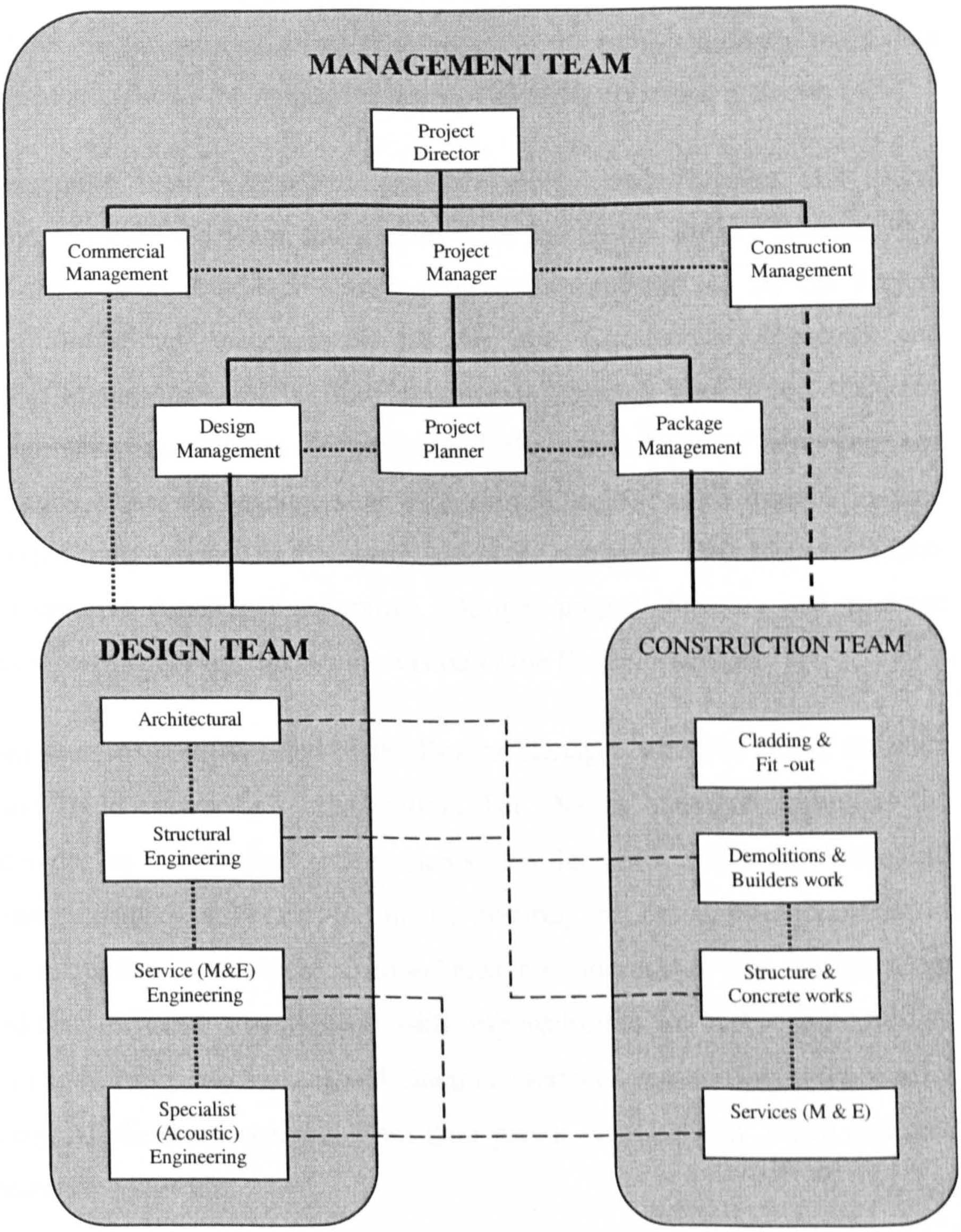

Figure 6.2 Team structure, relationships and roles – Case 1

Figure 6.2 illustrates the structure of the project delivery team in Case 1 and the relationships and roles within the team. The illustration is a functional representation with emphasis on the various teams that make up the project delivery team. The representation also shows the embedded units of analysis discussed in Section 4.5.2.

The management team comprised members from main Design and Build organisation and both the team and project were led by the Project Director. The team had three main functional areas; project management led by the Project Manager; Commercial management led by the Commercial Director; and Construction Management led by the Construction Director. The Project Manager, Commercial and Construction Directors had the same level of authority and responsibilities within the management team on the project. Their titles "Director" and "Manager" only referred to their rank within the company. They were all leaders of their respective functional groupings. Design, project planning and package management were under the direct supervision of the Project Manager.

The design team in Case 1 was led by the Design Manager, who was part of the main Design and Build contractor's organisation. The Design Manager worked as the coordinator due to the novated arrangements (see Section 2.3.2.2). He chaired all design team meetings and was responsible for ensuring that design changes requested by the construction team were comprehensively addressed. The design team comprised four different organisations with responsibilities for architectural design, structural engineering, mechanical and electrical services engineering and acoustics engineering. All the team operated from their parent organisations' office and only had representatives on site.

The Construction Director led the construction team which comprised a construction management executive, managers and supervisors from the Design and Build contractor and the various trade and package contractors. The construction managers were responsible for managing the on-site construction works within specific sections of the project. They were assisted by the construction supervisors who supervised the various activities within the section. Management activities within the construction team were handled by the Package Managers, within the main Design

and Build contractor's organisations. The various trade and package contractors had their own organisational structure and setup. Most of them were led by either a Project Manager or Contracts Manager/Director. Their setup was simpler with very little management staff. Their focus was more on direct labour and concentrated mainly on their package, trade or section of work. The package contractors had contact and interactions with each other except in areas where their activities were interdependent.

6.2.3 CASE FINDINGS

Using data from exploratory interview on good team practices and the team integration matrix, twelve issues were identified and used as focus for observations, interviews and documentation in Case 1. Table 6.1 summarises the key issues and the sources (discussed in Section 4.5.4) from which data were collected in the case study.

Table 6.1 Key issues and data sources – Case 1

Key issues of integration	Observations	Interviews	Documentation
Team structure		√	√
Operational boundaries	√	√	
Work relationships	√		
Information access and distribution	√	√	√
Delivery team location	√		
Linkage of offices	√		
Team member movements	√		
Interaction space	√		
Skills sharing and transfer		√	
Collective sense of achievement and responsibilities		√	
Working attitudes	√		
Informal relationship and mutual respect		√	

6.2.3.1 Observations

Data from simple observation used in this research (see Section 4.5.4.2) are presented in Table 6.2.

Table 6.2 Summary of observations on key issues of integration – Case 1

Key issues of integration	Observation of practices
Operational boundaries	• *Members of the delivery team attended meetings from their various organisations and reverted to them and often promise to complete any outstanding issues from their offices and distribute to other members who require response from them.* • *Members maintained their original identities and worked strictly within their given office space. Working procedures were in line with their organisation where they had moved to join the project delivery team.*
Work relationships	• *Working relationships among the various organisations were in strict accordance to the provisions of the contract.* • *Team members and organisation were clear about their duties and performed them without due regard to others.*
Information access and distribution	• *Access to information was limited within individual organisation and distribution was restricted to others members.* • *Distribution of drawings and comments were done electronically. Hard copies were made available to the construction team for use on site.*
Delivery team location	• *All the functional teams that made up the delivery team were in separate office locations.* • *All the teams maintained an open plan office but within their organisations.* • *The construction team was located within the same space but the various organisations partitioned their spaced and labelled them to maintain their identity.*
Linkage of offices	• *The restriction of the site did not allow for the physical linkage of the various offices.* • *There were no clear telecommunication facilities designed purposely to link the various offices both between and within any functional team.*
Team member movements	• *The open plan concept allowed free movement of members within an organisation. There were however restriction between organisations.*
Interaction space	• *The management team office arrangement encouraged the movement of members. The location of kitchen, toilets, printing equipment, meeting room and secretarial staff created conditions that would have members move into these common spaces from time to time.* • *The construction team members provided all their facilities within their own space. Space for interaction was therefore limited within a particular organisation. There was no provision for the various organisations to share any communal space for interaction.*
Working attitudes	• *Members within a particular organisation were generally friendly towards each other.* • *Members from other organisation were always ready to work together, especially where they both had a stake in the issue being resolved. This was evident in the works coordination meetings held at the close of work everyday to schedule deliveries and activities for the following day within the construction team.*

6.2.3.2 Interviews

Formal interviews conducted with leaders of the three main functional teams and informal interviews were conducted with selected members of the teams that make up the project delivery team are also presented. The selection of interviewees was based on criteria outlined in Section 4.5.4.3. The interviews provided more insight and understanding on the following issues.

Team structure

The delivery team was set up to maintain central control of the various organisations. The set up made it easier for the management team to effectively coordinate the high number of consultants and package contractors that were involved in the design of the project.

> *"We are set up in this way so that, as main contractors, we can maintain a central control of the project and the various participants".* ***- Project Director***

> *"The present team structure makes it easier to manage the various consultants who operate mainly from their respective offices. It's also easier to ensure that all issues are dealt with before and after meetings. On such a big project with tight completions schedules, things can easily get out of gear".* ***- Design Manager***

> *"We are used to the present set up and I believe it's the most suited to this kind of complex project where you expect so many trades and packages to be involved".* ***- Construction Director***

Operational boundaries

The need to operate within organisationally defined boundaries was defended as a way of ensuring that certain confidential issues are kept within the company. There was also the issue of whether people have the required motivation to abandon what they have been used to and adapt to a system which would last for just the duration of the project.

> *"I understand that we are doing this project together with other organisations but people always find it difficult to move away from structures and procedures that they are used to. I would not favour forcing people if they don't want to".* ***– Project Director***

Information access and distribution

Information was available to only those who require them. This approach had some limitations and prevented the free flow of information. Distribution was well organised but was electronically based which presented a few problems. It was integrated with the general e-mail system and with a high number of mails, there was increased likelihood of ignoring some information. The system was also difficult for those who were still coming to terms with having to deal with queries, especially on drawings, electronically.

> *"Our system is very good but there is the tendency to ignore some of the mails you receive that may require immediate attention. I also think that drawings are best assessed when you print them out". – **Construction Manager***

> *"You only get the information that you require for your section of work. That is not necessarily bad in itself. The problem comes when you need information on other sections of the project to inform you of how to proceed on your own section. Drawings are generally easy to access but other technical and contractual information that do not relate to your section can be difficult to get and sometimes involves a lot of hassle". – **Package contractor***

Skills sharing and transfer

There was no formal scheme for both sharing and transfer of skill was evident in Case 1. There was more learning than transfer or sharing of skill.

> *"It is difficult to clearly see how people transfer or share skill in a formal way. I think it comes through working together with your superior on projects, having meetings and basically picking up a few tips here and there". – **Package contractor***

Collective sense of achievement and responsibilities

Reward schemes instituted in Case 1 were geared towards a team rather than individuals. This ensured that members of the team think in terms of how they can do things together and achieve results that will benefit the team as well as individuals. Groups of individuals were given responsibility for sections of work and they were blamed and rewarded collectively.

"We make sure that as leaders we create the awareness that the success or failure of this project depends on all of us. We give people responsibilities but that goes with the right level of authority required to perform well. Accountability is one thing we also require but in all these, we try not to blame individuals for mistakes".
- Project Director

Informal relationship and mutual respect

In Case 1, everyone was treated as important. There were numerous channels available for people to seek redress, even on what appears to be very minor. The leadership was of the view that if little issues were not addressed, they will grow up to become big issues. Every facility provided within the project delivery team offices were available for use by all members and there were no distinctions.

*"We try to create the necessary environment for all members of the delivery team to relate to each other in a more relaxed way through social functions. Having fun is very much part of the culture here". – **Project Director***

*"It is something that develops with time. We have been working on this project for some time and I believe the relationships that exist are not bad at all. We respect every member for their professional competence and expertise". – **Design Manager***

6.2.3.3 Documentation

Very little use was made of documentation in Case 1. The organisation structure of the company was studied and restructured to show how the various functional team related to each other. This is shown in Figure 6.2. The only other use of documentation as a source of data was copies of emails detailing request for changes on an electronically transmitted drawing.

6.2.4 SUMMARY OF FINDINGS

The following summarise the findings from Case 1 based on observations, interviews and documents on key issues of integrations. The implications of these findings are discussed in Chapter Seven.

- The hierarchical structure distanced senior management from the lower members of the project delivery team. The structure was, therefore, not helpful towards integration of the whole team from top to bottom. The central control maintained by the leadership was, however, helpful in bringing the team together.

- The High teamwork spirit within individual organisations made little impact on the integration of the project delivery because they were limited within organisational boundaries. There was, therefore, lack of overall collective working approach amongst the various teams. The design team, for example, knew they were part of the project team but lacked the commitment to detach themselves from their individual organisations and be part of the project team. They considered themselves as project consultants with traditional supervisory powers.

- The open plan office arrangement of the management team and organisations within the construction team allowed free movement of people and more interactions amongst management team members. Seating arrangement (according to functional responsibilities within the project) allowed good discussions, easy direction of queries and response, and thus, the flow of information. Within the construction team, however, physical barriers were created by the individual organisations to create their own identity. The absence of the design team from site also created a collaboration gap which did not go down with both the management and construction teams.

- Organisations within the construction team worked in strict accordance with contractual provisions and made little efforts to work as a team. There was very little interaction/communication among them unless it was contractual. They dealt with the management and the design teams as provided for in their

contracts. There was very little formal contact outside of the contract provisions although they interacted informally after meetings.

- The locations of the various teams reduced the commitment towards the realisation of a single project team. Absence of the design team from the project office reinforced their traditional position and frustrated the construction team, in particular. There was a lack of understanding and cooperation between them on their new roles in a design and build arrangement.

- The use of electronic document control system allowed easy access, flow, and distribution of information. Drawings were still printed for better dissemination and use on site. The over reliance on electronic source of information reduced face-to-face interactions and further encouraged individual approach to working, which was detrimental to effective teamwork.

- Too much emphasis was placed on formal resolutions of problem that reinforces traditional attitudes of adhering to contract provisions even when issues can be resolved faster and better. Opportunities existed for informal interactions amongst the various teams which were more relaxed and open but that was because they did not have any contractual implications. There were no formal attempts to bring the various organisations that make up the project team to work as a single unit. Each organisation worked efficiently towards the achievement of their goals.

6.3 CASE 2

6.3.1 PROJECT BACKGROUND

Case 2 comprised a 32,000-seater football stadium, 6,000m² exhibition hall, 3,000m² conference and banqueting space, 69-bedroom hotel, 100-seater restaurant, fitness and health club and 2,000 car parking spaces at a cost of £60million. The project, which started in January 2004, and completed in July 2006, served as a catalyst for a regeneration scheme by the city council. At the time of the case study all preparatory and substructure works were complete. The superstructure had just begun with on-site personnel of between 25 and 50.

The project was funded by a local authority through a new company that was set up to implement a regeneration scheme in the north of the city. The project was originally set to be delivered through a construction management procurement approach (see Section 2.3.3.2), but negotiations with the contractor broke down. The design team was then novated to a new contractor in a Novated Design and Build approach (see Section 2.3.2.2) for the delivery of the project. The contractual format for the project is shown in Figure 6.2 below.

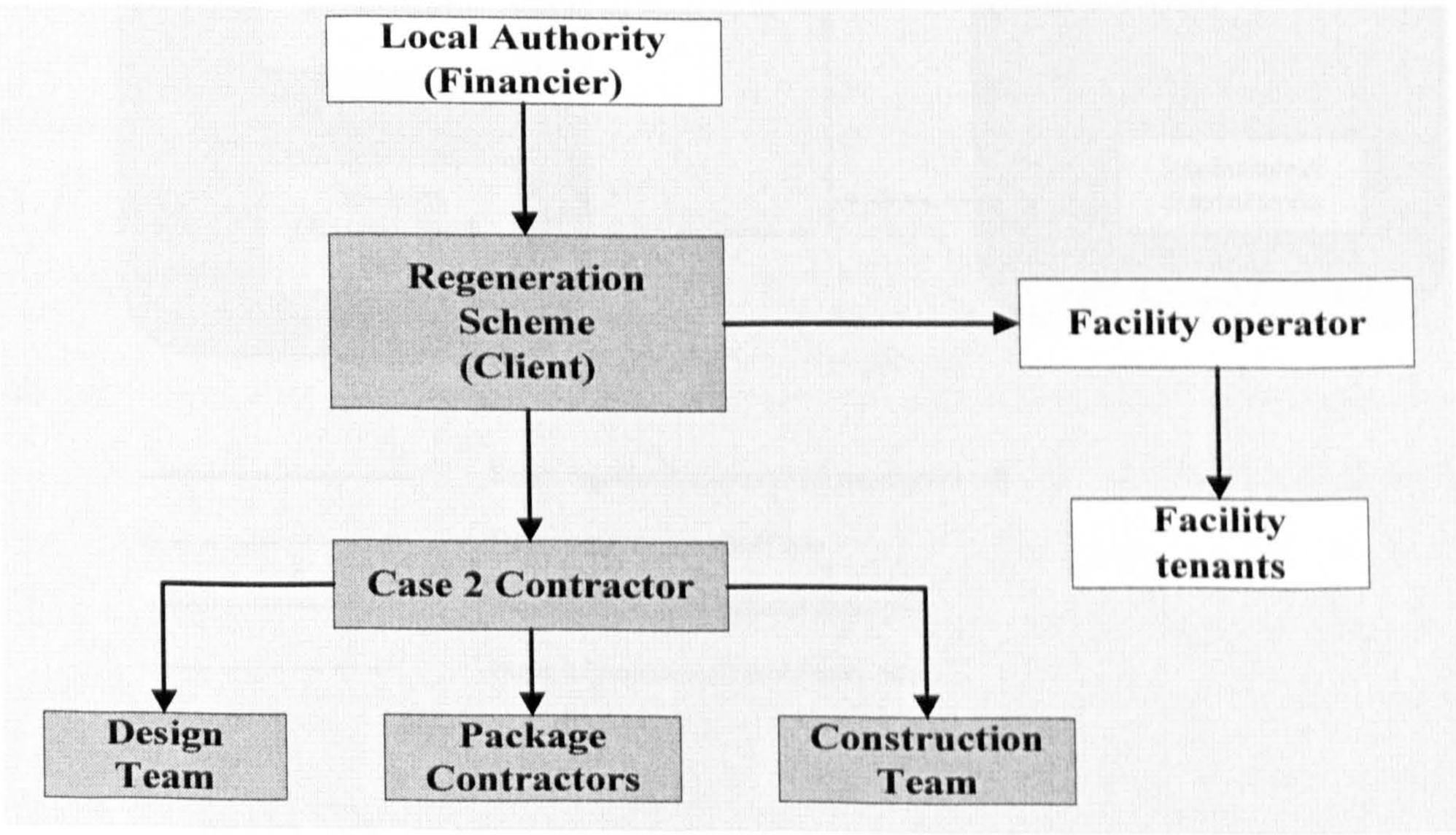

Figure 6.3 Contractual format – Case 2

6.3.2 DELIVERY TEAM STRUCTURE

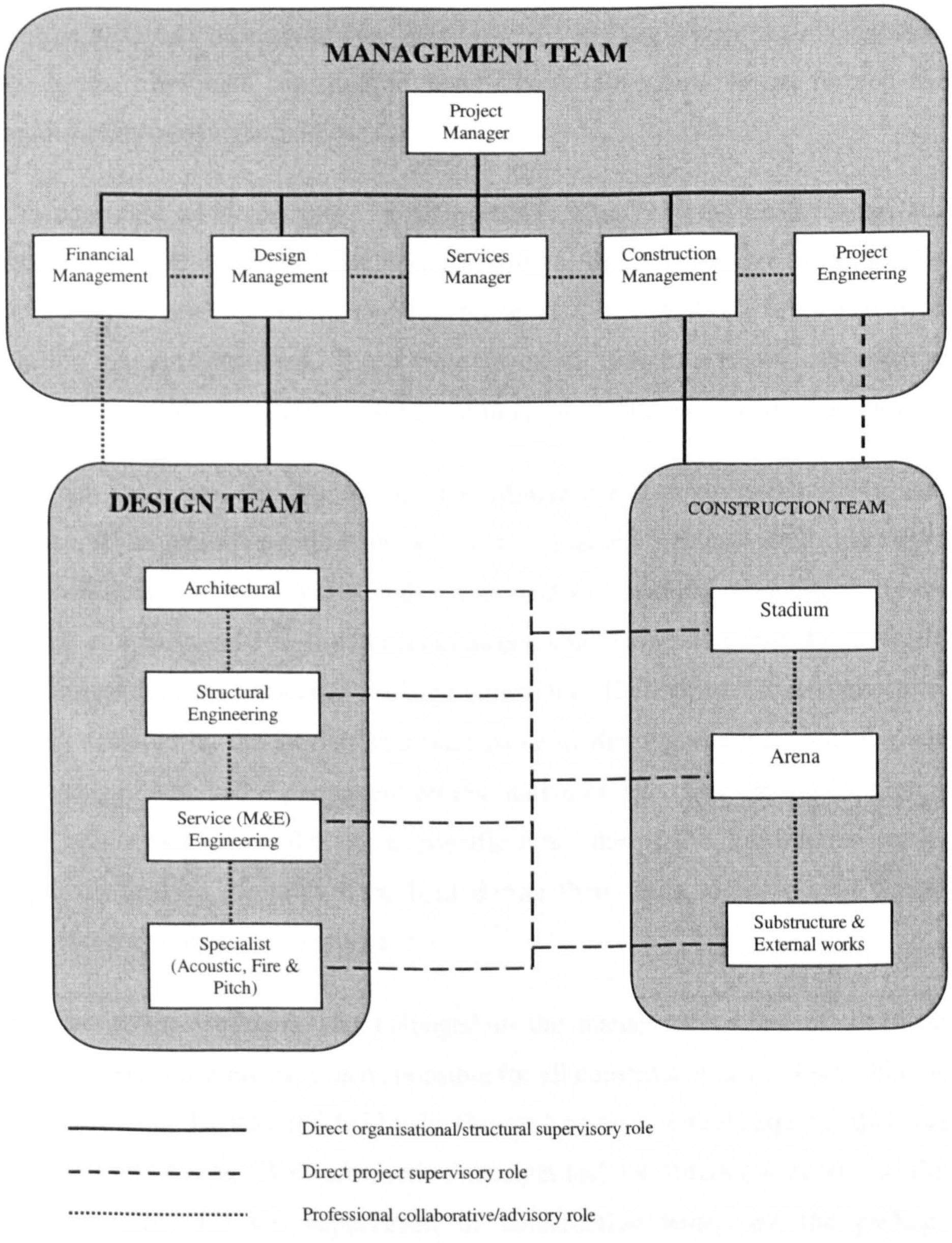

Figure 6.4 Team structure, relationships and roles – Case 2

The structure of the project delivery team in Case 2 is illustrated in Figure 6.4. The figure shows the relationships and roles within and across sub-teams. The structures within the main unit of analysis (see Section 4.5.2) in Case 2 were the management team, design team and construction team. These functional teams formed the embedded units of analysis of Case 2.

The management team was made up of members from only the main Design and Build contractor. The team had flat structure with the Project Manager, who was also the leader of the project delivery team, as the head. Case 2 had five functional areas within the management team. These were financial, design, services, construction and engineering. All management aspects of the project were dealt with at that level.

The design team was led by the Design Manager and comprised the Novated architectural, structural engineering, services, acoustic, fire and pitch specialists design consultants. Case 2 had a high component of structural work and that was given out as a package. The structural engineers, who were part of the design team, were employed by the structural package contractor. Their structural designs were, however, assessed by the Design Manager. None of the organisations, which made up the design team, had a permanent representative on site. The worked from their various offices but visited the site at specific times during the construction phase. Design coordination meetings ware held during their visits to resolve all design problems and construction variances.

The Construction Manager, who belonged to the management team of the main Design and Build contractor, was responsible for all construction activities within the construction team. He was assisted by the Project Engineer, whose responsibility was engineering and design. The Construction manager had construction supervisors who were responsible for the supervision of construction works by the package contractors. The Project Engineer had a small team of Engineers on site who were responsible for the design and production of site engineering details. Other members of the construction team were the package contractors responsible for the sections of the project. They had a more complete organisational setting and had offices set up

on the project site during the construction period. They were led by either a Project Manager or Project Director.

6.3.3 CASE FINDINGS

Table 6.3 summarises sources from which data were collected on twelve issues identified from exploratory interview on good team practices and the team integration matrix in Case 2

Table 6.3 Key issues and data sources – Case 2

Key issues of integration	Observations	Interviews	Documentation
Team structure		√	√
Operational boundaries	√		
Work relationships	√	√	
Information access and distribution		√	√
Delivery team location	√		
Linkage of offices	√		
Team member movements	√	√	
Interaction space	√		
Skills sharing and transfer		√	
Collective sense of achievement and responsibilities		√	
Working attitudes		√	
Informal relationship and mutual respect		√	

6.3.3.1 Observations

Simple observation techniques were used to gather data on key issues of integration within Case 2. The data collection techniques were discussed in Section 4.5.4.2. Table 6.4 summarises the observations made.

Table 6.4 Summary of observations on key issues of integration – Case 2

Key issues of integration	Key observations of practice
Operational boundaries	• *Members of the delivery team maintained their original organisational identities and worked strictly within their given office space. Working procedures were in line with their organisation.* • *There were no attempts by the various organisations, especially within the construction team to work together*
Work relationships	• *Working relationships among the various organisations were in strict accordance to the provisions of the contract.* • *The design team members worked together very well.*
Delivery team location	• *The management team had its separate office from which it operated. It maintained a cellular (closed) office plan* • *All the organisations of the construction team were located in different sections of the site* • *The design team operated from their offices outside the location of the project.*
Linkage of offices	• *There were no provisions to link all the offices.*
Team member movements	• *The cellular plan concept restricted movement of members within the management team. The office, however, provided the needed space and privacy where needed.* • *Movement between the various offices of the organisations on site were very formal and sometimes restrictive.*
Interaction space	• *The management team office arrangement did not encourage the movement of members. The only place for common circulation was the reception area where faxes were received and sent. It represented a very limited opportunity of space for interaction.* • *All the other organisations on site provided all their facilities within their office space. There was no provision for the various organisations to share any communal space for interaction.*

6.3.3.2 Interviews

In addition to observations, interviews were also used within Case 2 to gather information on how key issues of integration were addressed. The interviews were conducted with leaders and members of the various functional teams within the project delivery team. Key issues that were discussed in the interviews and a selection of key quotes are presented in this section of the thesis.

Team structure

The delivery team structure setup allowed the senior management to maintain good control of the project. The leaders of the various functional teams maintained direct contact with their team and that was key to structure of the project delivery team.

The team setup ensured everyone knew what had to be done and getting answers to queries did not take a long time due to the direct contact concept.

> *"Our set up allows us to focus on our own business and maintain direct contact with all the subcontractors who work for us. They do what we tell them and so far they have been very cooperative".* ***- Project Manager***

> *"Our team structure allows us to be very effective through a hands-on approach to managing the construction works. There are not many levels to go through before getting to the boss to resolve problems. The boss himself is a very practical and hands-on man".* ***- Construction Manager***

Work relationships

The leadership in Case 2 outlined roles and responsibilities clearly and provided the necessary support for the role to be performed well.

> *"It is very important you let everybody on the project clearly understand their role and then provide the necessary support that is required for better performance. There is no point telling people what they have to do and then leaving them on their own".* ***– Project Manager***

> *"I believe we are clear with what we have to achieve on this project. We are specialist in what we do and that is why the main contractor brought us on board. Of course we had to be very competitive with our bid".* ***– Package contractor***

Information access and distribution

Information is distribution was manually done in Case 2 but the system was very robust and was such that movement of project drawings especially to the design team were fully tracked. Access was purely on as required basis and there were no attempts to deny access to anyone who required any form of information that could be provided by the main Design and Build contractor.

> *"We use a comprehensive system of information distribution that ensures that all drawings that leave our office are noted. Those that return are clearly marked. We generally give out information to those who, in our opinion, need the information. Its all about confidence in what the information will be used for but I believe we do our best not to withhold any information".* ***– Design Manager***

*"You only get the information that is relevant to your portion of work. In our case, most of the design information we require are produced by our consultants and when we need approval, it comes fairly quick". – **Package contractor***

Team member movements

Member movements were supposedly unrestricted according to the management team but the very setting portrays some restriction in how freely people could move. Key personnel within the management team maintained a cellular office. Meeting room and reception areas were centrally located but there was very little interaction with permanent occupants.

*"Our doors are always open and that should tell you that we do not restrict access to anybody. You are free to walk in anytime. This set up gives you the privacy and the quiet environment that you sometimes need to get things done. I think it's a matter of choice and we prefer this one". – **Project Manager***

*"Their set up should tell you that you are not always welcome. I think the best work environment is the open plan and that is why we have set up this way. You give people the freedom to move freely". – **Package contractor***

Skills sharing and transfer

There were no formal systems in place geared toward skill transfer and sharing.

*"We do our very best to provide learning opportunities for the young ones. As you can see our set up is very small but notwithstanding we have quite a good number of young guys learning on the job. It shows our commitment to share and transfer our skills". – **Project Engineer***

Collective sense of achievement and responsibilities

There were no clear indications of any reward schemes in Case 2. They were more of intentions rather that existing practice of a system or scheme.

*"If you work as a team then you will always be proud of your achievement together. This is what we try to achieve on our projects. We work together and share our achievement. Of course that goes with collective responsibility". - **Project Manager***

"Yes within our company, we try to make sure that whatever we achieved is shared across board. I cannot say anything for the main contractor, but collective sense of achievement and responsibility is the way forward to get the best out of your workers". ***– Package contractor***

Working attitude

The senior management of the management team maintained a strong presence and cooperated with other members of the project delivery team. There was little or no confrontation. Problems were tackled together and often on site where it was. There was a practical approach to problem resolution and all responsible members of the team were involved and on site.

"The best way to resolve problem is to be there on site to see how practical your solution will be. There is no point sitting in the office trying to recommend solutions. It's unfortunate that we start the design from the office but I believe that the site has a lot to offer". ***– Project Manager***

"When you are on site and at where the problem has occurred, you get the best opportunity to resolve it once and for all". ***– Construction Manager***

Informal relationship and mutual respect

The leadership in Case 2 was viewed as autocratic and inflexible by some package contractors but they provided avenues for every member of the delivery team to be involved and recognised their contributions The respected and acknowledged the professionalism of all the organisations involved in the project as well as the individuals.

"Everyone on this project is here because they have something to offer. We as the main contractors try to allow everyone to operate within reasonable limits so that the best solutions would be achieved for the project". ***– Project Manager***

"We know he (the Project Manager) is very tough but that in itself is not bad but it depends on how it affects his relationship with us" ***– Package contractor***

6.3.3.3 Documentation

Figure 6.4, showing the delivery team structure, was produced using information obtained from Documentation. Their system of information distribution also obtained

from documentation is described below.

1. All drawings received were stamped on the day of receipt and reference number booked into the document control book.

2. The drawings are then forwarded to the appropriate section within the project delivery team. They are recorded before they leave the document control room.

3. Drawings that are issued for comments are returned to the office where their receipt are acknowledged and forwarded back to the source.

The system ensures that all drawings in and out of the company are accounted for and fully attended to.

6.3.4 SUMMARY OF FINDINGS

A summary of findings in Case 2, which are discussed in Chapter Seven are listed below.

- The project team structure was direct with a firm leadership that had control over the project to ensure the achievement of the tight completion date. Collective effort was encouraged, especially in the resolution of construction problems. It was, however, difficult to predict whether there was compliance or commitment and also whether leadership was respected or feared. The leadership was in direct contact with all levels of personnel on the project. It use a hand-on approach in managing personnel.

- There was total commitment on the part of all the teams (management, design, and construction) individually, to the key project objective of completing the project on time. There was excellent teamwork spirit and that helped the unit work more collectively and effectively.

- The cellular office arrangement did not allow easy movement of people although that was encouraged within the management teams. It, however, gave the necessary privacy and was an indication of rank in the management team

structure. The segregation of offices created and "us and them" perception among the lower level management personnel. This did not necessarily affect teamwork spirit but created a distance between teams.

- Very little confrontation between the design team (led by a strong design manager) and the package contractor (design team) in resolving issues. The same could not be said of other package contractors' teams that were not involved in design. The design team was not based on site but their visits were regulated and issues for discussion were exhausted at meetings. The team had a consultancy mentality but only to the main Design and Build contractor.

- The hands-on approach used in the management of the project encouraged teamwork within the construction group. This was an underlining culture of the management team's approach to work but all the teams were set up and worked as individual organisations. They had little or no interaction with other others except for contractual obligations such as site and design progress meetings.

- Paper based document control system used was very effective in getting people to sit and resolve problems together. It created a teamwork awareness approach to problem solving but access to information was restricted because distribution was to recipients only.

- Limited opportunities existed for other teams to informally interact with each other. The design team was not based on site and all the organisations that constituted the construction teams were located in separate offices. Most of the public relationships and social programmes that could have brought the whole project team together were mostly attended by the management team.

- There were no formal attempts or structures in place that was teamwork focussed/based or targeted at engendering effective teamwork. The focus was on high performance from individual teams and members to deliver the project on time.

6.4 CASE 3

6.4.1 PROJECT BACKGROUND

Case 3 was a landmark 16-storey block of 28,000m² net floor space comprising 43 courtrooms, 4 tribunal courts, 73 consulting rooms, additional office and support space. The project started in May 2004 and is expected to be completed in January 2007 at the cost of £113million. The cantilevered extensions of the building and the natural ventilation system are some of the unique features of the block. The case study was conducted when work had just commenced on site. The delivery team on site was, therefore small with no more than 25 people.

Case 3 was part of a major managed business district development which resulted from a lease agreement between a private developer and a government department. The local authority was also part of the partnership that initiated the project. The conceptual design of the building was completed by the winning design team which was then novated to the Design and Build contractor. The procurement arrangement was, therefore, Novated Design and Build, discussed earlier in Section 2.3.2.2 of this thesis. Figure 6.3 shows the contractual format for the delivery of the project.

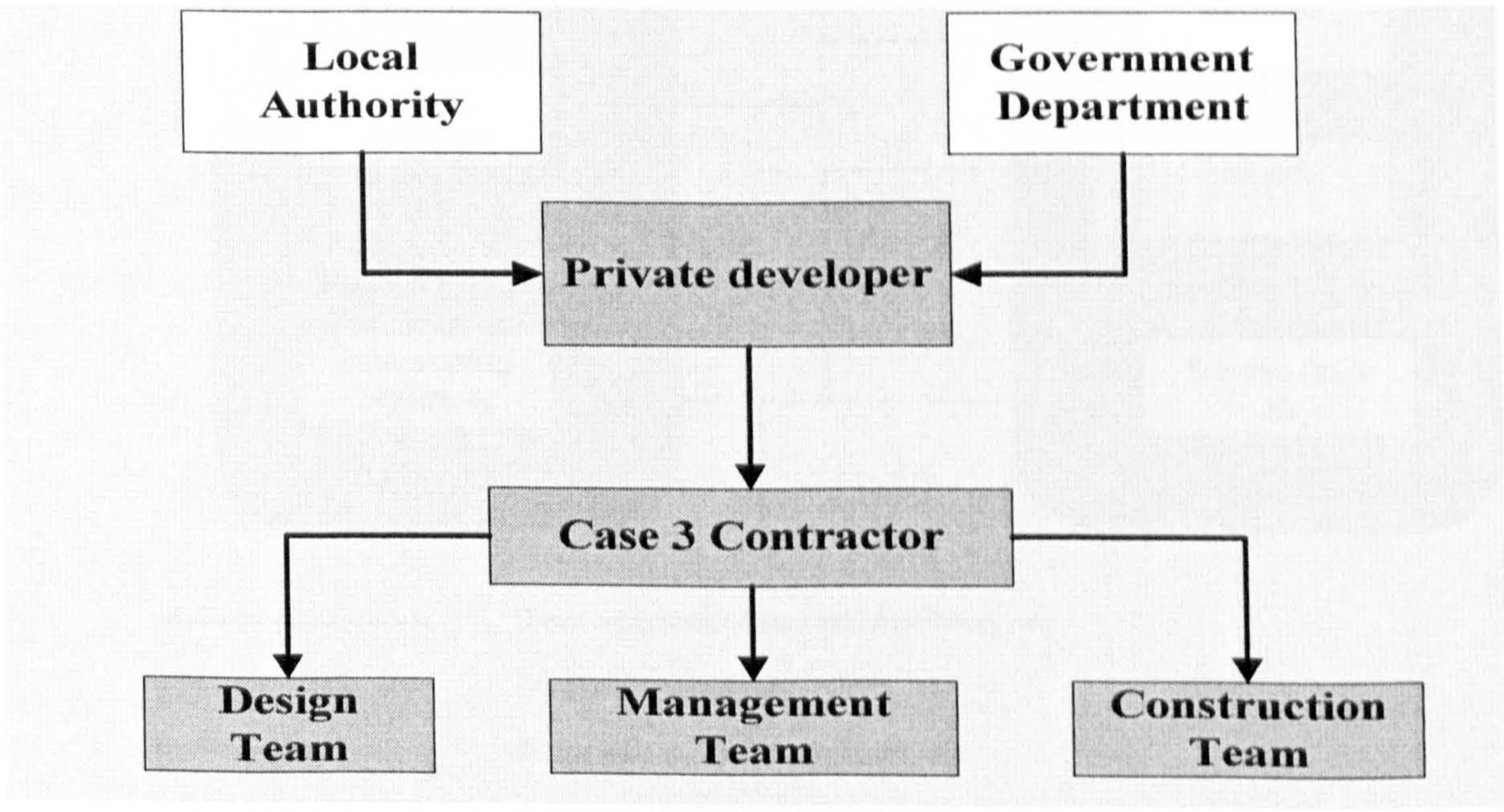

Figure 6.5 Contractual format – Case 3

6.4.2 DELIVERY TEAM STRUCTURE

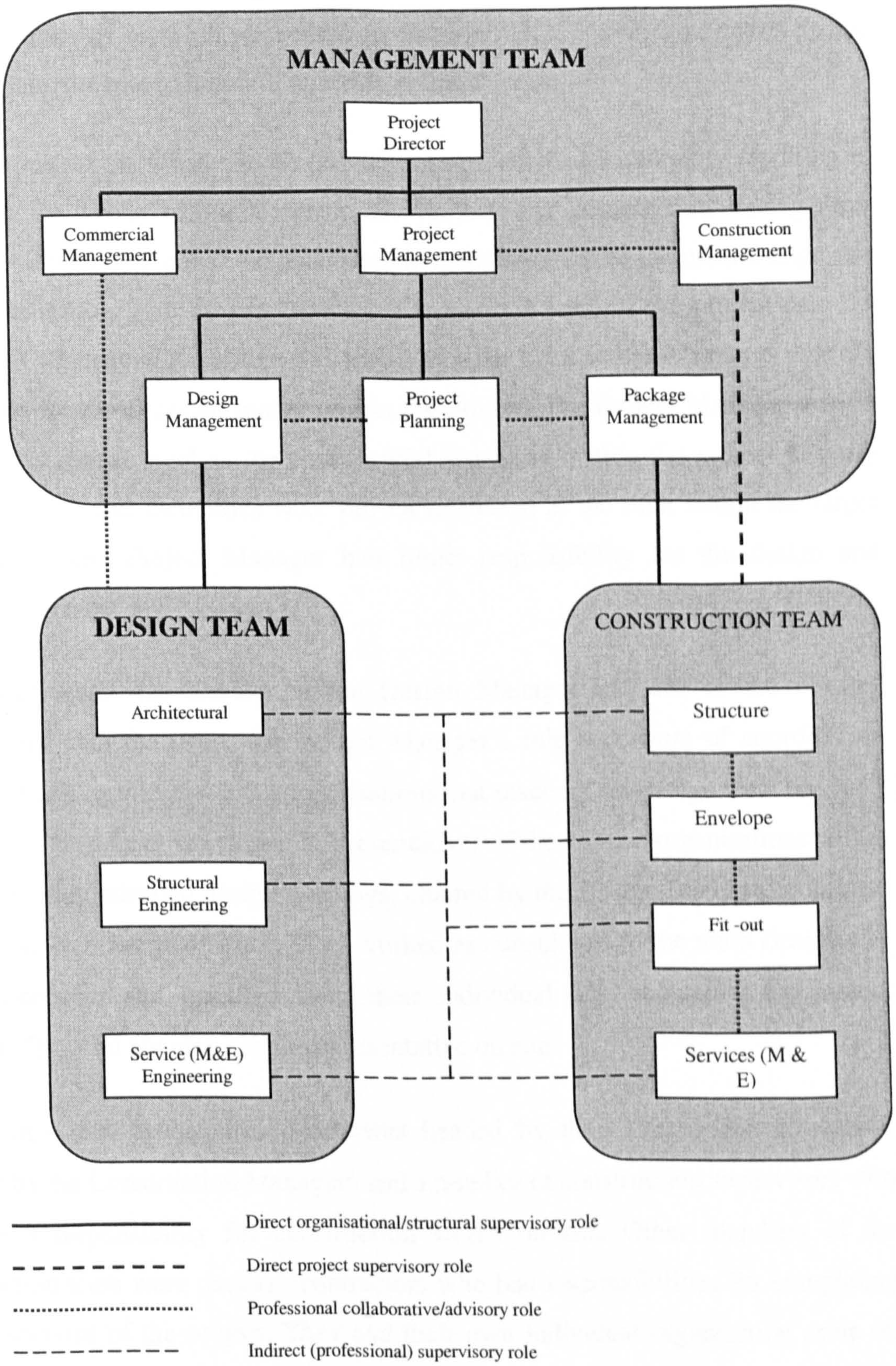

Figure 6.6 Team structure, relationships and roles – Case 3

The structure, relationships and roles within the project delivery team in Case 3 are illustrated in Figure 6.6. The figure shows the various functional teams classified as embedded units of research, discussed in Section 4.5.2. These units make up the delivery team, the research unit of analysis within the case.

The management team had the Project Director as the leader. Directly reporting to him were the heads of the commercial, project and construction management sections. All the members of the management team belonged to the main Design and Build organisation. The Project Director was also the head of the project delivery team. The Commercial Executive was assisted by the Commercial Managers who are responsible for the financial matter within the project. The Project Manager was on the same functional level as the Commercial Executive within the project delivery team of Case 3 and their titles were only a reflection of the rank within the larger organisation. The Project Manager had direct responsibility for the design and construction teams.

The design team was headed by the Design Manager and due to the novated arrangement with the team, the Design Manager's role was more of coordination than direct management. All the organisations that made up the design team had their complete management structures. Representatives of the various organisations within the design team attended design meetings, chaired by the Design Manager to discuss design issues on a regular basis. They worked as consultants to the main Design and Build contractor and operated from their individual offices outside the project location. They did not also keep a representative on site.

The construction management team was headed by the Construction Executive, assisted by the Construction Managers and a number of construction supervisors who had direct responsibility for construction works on site. Other members of the construction team were package contractors who had responsibilities for completing certain sections of the project. They had their own individual organisation setup on the project site. The management of the package contractors within the project delivery team structure was carried out by the package managers who operated within the management team and reported directly to the Project Manager.

6.4.3 CASE FINDINGS

Table 6.5 is a summary of sources from which data were collected on twelve issues identified from exploratory interview on good team practices and the team integration matrix in Case 3.

Table 6.5 Key issues and data sources – Case 3

Key issues of integration	Observations	Interviews	Documentation
Team structure		√	√
Operational boundaries	√	√	
Work relationships	√		
Information access and distribution		√	
Delivery team location	√		
Linkage of offices	√		
Team member movements	√		
Interaction space	√		
Skills sharing and transfer	√		
Collective sense of achievement and responsibilities		√	
Working attitudes	√		
Informal relationship and mutual respect		√	

6.4.3.1 Observations

Using simple observation techniques data gathered on key issues of integration within Case 2 are summarised in Table 6.6. The data collection techniques were discussed in Section 4.5.4.2.

Table 6.6 Summary of observations on key issues of integration – Case 3

Key integration issue	Key observations of practice
Operational boundaries	• *Members of the delivery team viewed themselves as different organisations that have come together for the delivery of a project. They never worked towards operating as a new project team.* • *The systems and procedures in place within individual organisation were those used in their respective parent organisations.*
Work relationships	• *All members of the project delivery team worked in strict compliance with the contract provisions.* • *Clarity of responsibility, especially within the design and construction teams were as far as the contract provisions.*
Delivery team location	• *The management team responsible for project and design management were in a separate location close to the project site. Some of the package contractors had been given spaces elsewhere in the building for their top management.* • *The construction team and the construction management personnel within the management team had their offices on site but occupied different cellular office spaces.* • *All the design members, except the Design Manager, operated from their own office outside of the project location.*
Linkage of offices	• *There was a telephone link between the various offices of the members of the project team that were physically separated due to space limitations.*
Team member movements	• *The management team office had a combination of open plan and cellular offices. Movements were substantially free within the team office.* • *The package contractors had cellular office spaces but open plan within that allowed member movements. This did not apply to other members of the construction team.*
Interaction space	• *The location of changing facilities and canteen provided the only opportunity for all the members of the project team to interact. The facilities were used by the non-management members of the project delivery team. There were no spaces for management members to interact with the junior members.* • *The level of interaction within individual organisations was good due to the open plan arrangement. There were, however, no specific spaces created to encourage members within the project team to interact.*
Skills sharing and transfer	• *There were a few trainees on site to learn on the job from senior and qualified colleagues within the construction management team.* • *Site training programme were organised regularly, mostly on health and safety.*
Working attitudes	• *Members focussed on their own area of operations and made very little effort to work with others.* • *Collaborative efforts were only seen in areas where operations are interdependent and contractually obligatory*

6.4.3.2 Interviews

Interviews were conducted within Case 3 to throw more light on issues that were observed and to find out on issues that were not observed in the course of the case study. The interviews were conducted with leaders and members of the various functional teams within the project delivery team. Key issues that were discussed in the interviews and a selection of key quotes are presented in this section of the thesis.

Team structure

The delivery team structure was hierarchical but there were a lot of direct contacts between superiors and subordinates. The top management made a lot of efforts to bridge any gaps that existed between the various levels within the structure.

> *"Our team structure allow us access to all areas of operation and we try to maintain a good balance of expertise on site and in the office to deal with the various aspects of the project"- **Project Director***

> *"I basically run the project and I am in contact with the site all the time. I get "dirty" when the need be so that we, the management, are not perceived to be only interested in staying in the clean offices. I believe the office cannot be as dirty as the site because in a way it represents our image" – **Project Manager***

Operational boundaries

All the organisations within the delivery team operated distinctly. There were little or no attempts to operate as a single project delivery team.

> *"We are all different companies and would be very difficult and almost unachievable to have every organisation operating as a new project delivery team. I think the present setting is nothing strange. It's up to management to come out with systems and procedures that will get the best out of the teams. It is ok for the team to have their micro view and then we will coordinate them to fit into the macro view of the project" – **Project Director***

> *"We do not operate as one big project team because we came into the project on individual basis. There were no attempts on the part of the main contractor to introduce us to those already on site. So from day one, we came in alone and we have naturally continued to operate individually" – **Package contractor***

*"I don't see the problem with operating as individual companies. Everything is down to price. We have put in a price to do a job and that is what we set up to do. What happens when others don't perform at the level you do? Who pays for bringing them up to your level? I think we are comfortable working within our own boundaries" – **Package contractor***

Information access and distribution

Information was distributed electronically using a document transmission system. Drawings are put on the system and circulated for comments and reviews. They are subsequently updated and issued out for construction. At that stage, they are printed and used on site.

*"Our electronic transmission system ensures that drawings are received, dealt with and returned promptly. The only possible downside is that it sometimes take away face to face discussions but under the present circumstance where we do not have the Architects and the Engineers with us on site, it works very well" – **Design Manager***

Collective sense of achievement and responsibilities

The project was broken down into sections and responsibilities given for the delivery of that section. There were no clear indications of collective responsibility as teams operated individually but within a particular section, members worked very hard towards achieving, as a team, targets that have been set for them.

*"As the leader of the project team, you try to get all the guys to think in team terms. It is the only way of ensuring that when things go wrong they can be addressed collectively. So far we have done that pretty well on this project" - **Project Director***

*"When you give people the opportunity to prove themselves as capable, you also have to have in place a system that will reward them. What we try to do here is to give sections of the project to small teams and then give them total control to deliver the section. When that is done well we make it known to them. We don't necessarily give them any financial rewards but little praise here and there really helps to get the best out of the team". – **Construction Manager***

Informal relationship and mutual respect

Top management put in a lot of efforts in fostering and improving relationships among the members of the delivery team. Social functions and activities played a

major role in that. People were also treated as professionals for what they do on the project.

> *"We treat everyone on this project with respect. To us, everyone's contribution is needed for the success of the project. Opportunities are, therefore, created through meetings at the lowest possible level to ensure that everyone is heard. When we organise social function, positions are completely abandoned and that brings everyone to the same level, more or less"* – ***Project Director***

> *"We are respected for what we do and we also have fun when we all go out on social nights and I think that is really good in bringing us together at the informal level"* – ***Construction Supervisor***

6.4.3.3 Documentation

The only use of documentation as a data source was the organisation chart of the project. This has been restructured to show the relationships and roles between the various functional groups within the project delivery team.

6.4.4 SUMMARY OF FINDINGS

The main findings in Case 3 are discussed in Chapter Seven. A summary of the finding are, however, summarised below.

- The delivery team structure was tall and hierarchical but had an all-involving leadership style that made every effort to bridge any existing gaps between the various teams on the project. Top management was respected but often seen as "too polished to get dirty" and, therefore, belonged to the office.

- High teamwork spirit individually within the management and design teams. Good understanding and trust among the design team members. There was also good collaboration and cooperation between the design team and the construction team.

- A combination of open plan and cellular office space arrangement allowed easy and gave privacy where needed. The teams or groups in the cellular spaces saw themselves as being the lower rank. There were, however, opportunities for both occupiers of both offices to mix up due to the absence of certain facilities in both

settings. Seating arrangement in the open plan offices allowed good discussion among functional groups, mainly within the management team.

- Both paper and electronic document control systems were used due to the separation of offices. Those with access to electronic access had better information flow and access and lacked face-to-face interaction and vice versa for those with paper access. The system was deigned that the construction team and the management team members responsible for construction used the paper system, which was appropriate.

- Organisations making up the construction team were introduced into the project team individually and they remained and worked as individual teams. There were no avenues for them to act together and that was not helped by the absence of incentive for team working within contract conditions.

- Significant attempts were successfully made at informal interactions through social activities but most team did not attempt any such gathering of their own. Their interaction also remained social and did not extend to the work environment due to contractual and financial constraints No formal structures existed to engender teamwork spirit in the overall project team.

6.5 SUMMARY

The chapter presented findings of the three case studies carried out to further explore practices toward team integration within large Design and Build project delivery team environments. It presented the background information of the projects and the structure, relationships and roles of the delivery teams. Simple observations, interviews and documentation were used as sources from which data were collected.

Case 1 had a tall and hierarchical structure with distant leadership which was not helpful in bringing the team together. Leadership style was delegative or free reign and relied on the commitment of team members. Teamwork was high within individual organisations but that did not impact on the integration of the project delivery team. The open plan office arrangement in Case 1 allowed free movement of personnel and increase interactions. The various organisations worked in strict

accordance with contractual provisions. There was easy access to information and distribution was effectively done. The management team in Case 1 created opportunities for the various teams to interact informally in a relaxed environment through social functions. The organisations were not encouraged formally to work as a single unit and the absence of the design from site did not help.

The delivery team structure in Case 2 was flat and direct. The leadership was autocratic but adopted a participatory style that brought it in close and direct contact with the team and integrated better. Teamwork spirit was excellent but the focus was on individual rather than team performance. The cellular office arrangement in Case 2 did not adversely affect the integration of the team but the absence of the design team from site did not help. There were good examples of cooperation and confrontation between parties were limited. An effective paper-based document control system improved face-to-face interactions but restricted access to only recipients. There were limited opportunities for informal interactions with each other.

Case 3 had tall and hierarchical team structure with participatory leadership style that bridged the gaps between the various teams on the project. There was high teamwork spirit within the management and design teams. There were, however, no attempts at engendering the integration of the project delivery team. This was further set back by the absence of the design team from site. A combination of open plan and cellular office space arrangement allowed easy movement and access to people but gave privacy where needed. In Case 3 both paper and electronic document control systems were used resulting in better information flow and access and improved face-to-face interaction. Team members had the opportunity to interact informally through social activities.

The cross-case analysis and implications of the findings from the three case studies presented in this chapter are now discussed in the next chapter (Seven) to highlight key issues of integration within project delivery teams. The issues identified guide the development and validation of a framework to improve team integration which is presented in Chapter Eight.

CHAPTER SEVEN – CROSS-CASE ANALYSIS OF KEY INTEGRATION ISSUES

7.1 INTRODUCTION

The theoretical background for the research was provided in Chapters Two and Three. Chapter Four discussed and selected the methodological frameworks for the research process, which comprised two phases. The details and results of the first phase were discussed in Chapter Five and the conclusions provided the basis for the conduct of the second phase. The findings from the second phase of the research process have been presented in Chapter Six.

This chapter presents a cross-case analysis of the findings from the second phase of the research (case studies) to address the key research questions posed in Section 1.4 of the thesis. The chapter discusses the key issues of team integration within construction project delivery team. The development, overview, and validation of framework for improving team integration are also presented in the chapter.

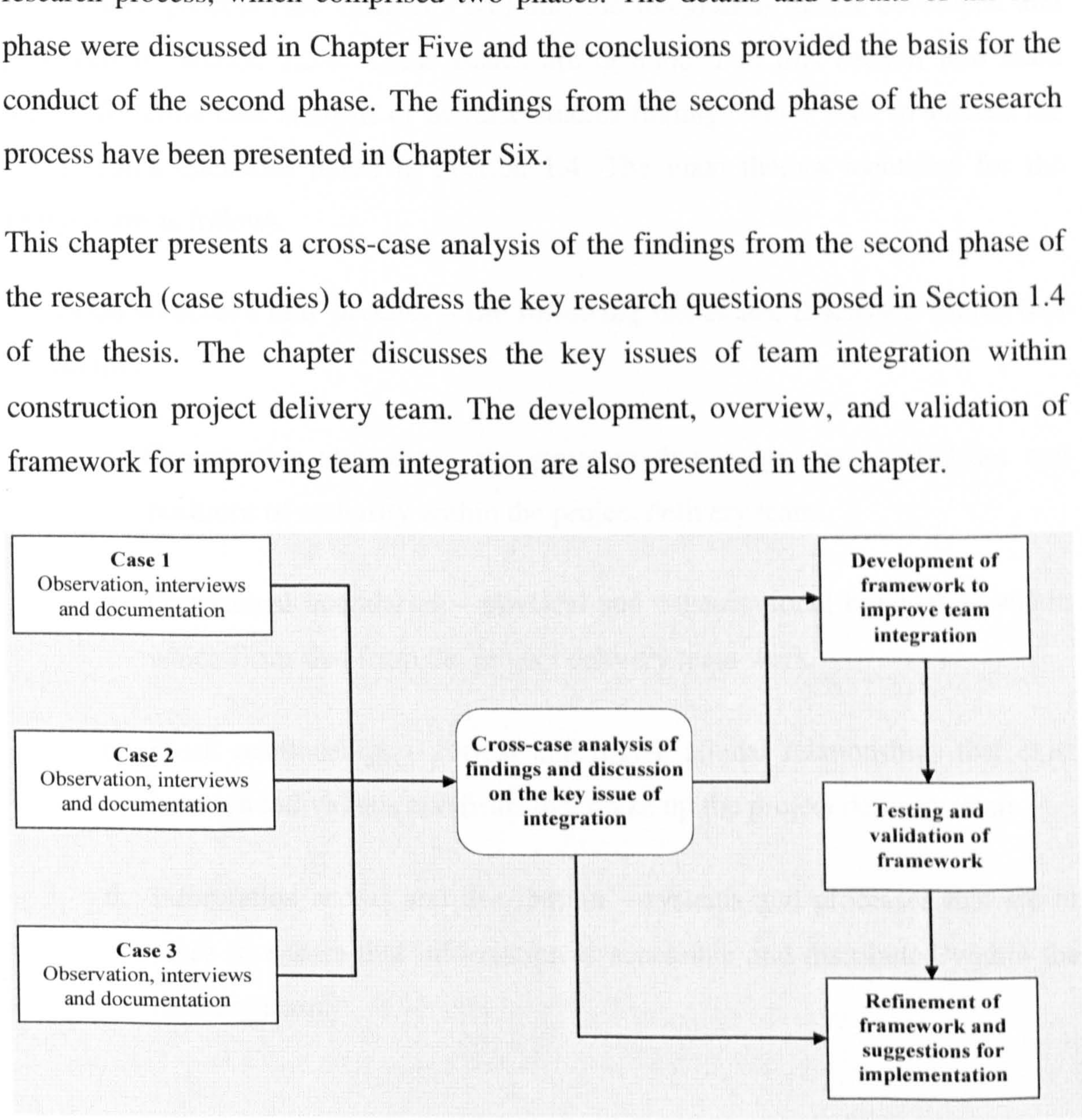

Figure 7.1 Overview of cross case analysis and framework

This section of the thesis analyses the findings from the three case studies presented in Chapter Six. The main themes for the analysis are first identified (Section 7.2.). This is then followed by detailed cross-case analysis of the key issues of integration under the main themes (Sections 7.3, 7.3 and 7.5). A summary of findings from the case studies and implications of the findings are then presented (Section 7.6).

7.2 THEME IDENTIFICATION

Findings from the case studies, presented in Chapter Six were based on the twelve key issues of integration practices synthesised from the results of the first phase of the research process (see Chapter Five) and the integration matrix developed and presented in Section 3.5.4. These issues are developed in this section into main themes for cross-case analysis of the case studies findings which seek to address the key research questions posed in Section 1.4. The main themes identified for the analysis are as follows.

1. **Team structure and process – the following issues are discussed under this theme:**

   a. Organisation structure – the structure that assigns responsibilities and positions of authority within the project delivery team.

   b. Operational boundaries – physical and organisational boundaries within which firms that form the project delivery team work.

   c. Work relationships – formal and organisational relationships that exist between individuals and firms that make up the project delivery team.

   d. Information access and distribution – systems and processes that are in place to ensure that information is accessible and distributed within the delivery team.

2. Work environment – the following issues are discussed under this theme:

a. Delivery team location – the office space or spaces within which the project delivery team is located and work from.

b. Linkage of offices – the system or structures put in place to ensure that functional or organisational teams that cannot be co-located due to geographical restrictions are appropriately connected to each other.

c. Team members' movement – the spatial arrangement within the project delivery team setup that impact on the movement of members within the setup.

d. Interaction space – the creation and/or provision of space within the delivery team location to engender both formal and information interactions among members.

3. Team culture – the following issues are discussed under this theme:

a. Skills sharing and transfer – the willingness or otherwise, of how individual functional teams or the project delivery team share and transfer their skill for mutual benefits and that of the project.

b. Collective sense of achievement and responsibility – this is an indication how of members viewed their achievement as collective rather than individual within their organisations and project delivery team. It is also a measure of team members' responsibility towards each other.

c. Working attitudes – the attitudes and behaviours of the project delivery team members towards work. This included what was viewed within a team as a norm and acceptable practice.

d. Information relationships and mutual respect – how members of the project delivery team related to each other outside of formal work relationship and the recognition of professional competence of all members.

7.3 TEAM STRUCTURE AND PROCESSES

Table 7.1 Cross-case comparisons of team structure and process

	Case 1	Case 2	Case 3
Organisational structure	- Functional, tall and hierarchical. - Distant senior management. - Delegative leadership style. - Central control of organisations that made up the project delivery team.	- Functional, flat and direct. - Senior management in direct contact with functional leaders. - Autocratic leadership with participatory style. - Decentralised control of project delivery team member organisations.	- Functional, tall and hierarchical. - Senior management in direct contact with functional leaders. - Participatory leadership style that bridged the gaps among the various teams. - Decentralised control of the project delivery team.
Operational boundaries	- Limited to individual organisations. - Awareness but lack of motivation to becoming part of the new project team.	- Restricted to original organisations within their given project office space. - No attempts by project delivery team organisations to operate within any common space.	- Limited to individual organisations. - Minimal attempts (only within the Design team only) to operate as a single project delivery team.
Work relationships	- In strict accordance with contract provisions. - Clarity of duties for individuals and organisations.	- In strict accordance with contract provisions. - Clarity of duties for individuals and organisations. - Support provided for roles to be performed well.	- In strict accordance with contract provisions. - Clarity of duties for individuals and organisations.
Information access and distribution	- Easy access to information limited within individual organisations. - Restricted access to information to other members of the team. - Electronic distribution of information. - Hard copies available for use on site by the construction team.	- Access to information on as required basis. - No deliberate attempt to deny team members access to information. - Centralised paper-based information distribution system. - Strict tracking and control system of distribution.	- Easy access to information within the design and management teams. - Access to information limited to contractual requirement within the construction team. - A combination of electronic and paper-based information distribution.

7.3.1 ORGANISATION STRUCTURE

Two basic types of organisational structures for project delivery teams emerged from the case studies. These are: tall and hierarchical; and flat and direct (see Table 7.1, row one). All the structures were functional. This implied that positions within the team were based on the functional expertise of member organisations and individuals. This is expected in large project team structure where several functional skills are expected to be employed in its delivery. The need for integration became obvious as all the functional expertise that are required for the project would have to be brought together to act within a single unit.

The tall and hierarchical structures distanced the senior management from the rest of the team. This was evident in Case 1 where the senior management was difficult to access especially by the non-management members of the team. The structure calls for robust procedures to ensure that senior management, who are policy makers, get the right kind of information. For teams to be integrated into a single unit, direct access to all levels of management is very important. This is necessary to ensure that information freely flows to targeted sources without distortions. The "them and us" situation is also avoided and that improves the level of togetherness within the team.

Case 3 had a tall and hierarchical structure but the senior management was able to establish direct contact with the various functional leaders in a similar fashion like Case 2 which had a flat and direct structure. This was relatively easy to achieve as the project, at the time of the research, was at the early stages and the full blown project delivery team was not yet in operation. There were, therefore, fewer people involved and positions of the members were not entrenched. Goodwill was very high and the team could be said to be in its forming stages, discussed in Section 3.3.2.

Ordinarily, the most suited structure that facilitated team integration was in Case 3. A flat and direct team structure ensures that everyone within the team has equal access to senior management and allows the whole team to act as a single unit. The structure is flexible and responsive order can easily be maintained as discussed in Section 3.3.4. Anyone that visited the Case 3 could not readily distinguish between senior management and the rest of the team. All you noticed was a team working together

on a project. Problems were resolved together and the senior management was well informed and fully aware of all issues on the project. Solutions were more practical and applicable and were also seen more as a collective solution than imposed by the senior management. This created an atmosphere of togetherness within the project delivery team, which is very necessary for integration as highlighted in the integration matrix in Section 3.5.4.

Three distinct leadership styles were found in the case studies. In Case 1, the leadership style was Delegative, allowing other members of the team to take decisions on behalf of the leadership. Case 2 leadership combined autocratic and participatory leadership styles. The leadership knew what they always wanted but involved other members to come to a conclusion. A fully participatory leadership, which is most suited to integration as it involves all members of the team in decision making, was used in Case 3. The style created an atmosphere where every member felt he was part of the team.

The various leadership styles used were all effective under the prevailing circumstance. In Case 1, for example, the best option to ensure that decisions were taken was to empower individuals within the management structure to do so. The very large nature of the delivery team and the complexity of the project meant that one group of individual had the necessary skill and expertise to control every aspect of the project. The time sensitivity of Case 2 was such that any slip up in programme would be very expensive. The leadership had to champion the way forward to deliver the project and hence, the autocratic style was suited to the situation. The mixed approach adopted, however, ensured that other members of the team bought into the vision of the leadership. Case 3 was in its early stages and the management were focussed on building a team where everyone had a part to play. Participatory leadership style ensured that both senior and other management of the delivery team worked together to deliver solutions that were required on the project.

Within any project team structure, the control of the organisations that make up the team is very important. This is often dependent on the procurement option used for the project as discussed in Section 5.4.2. All the projects studied were novated design

project in the most efficient and effective manner. The continued operation within individual organisational boundaries also makes it difficult to implement any strategy that is to be implemented by the whole project team.

Members of the delivery team continued to see themselves as belonging to different organisations and, therefore, worked to protect the interest of their parent organisations. Positions of interest were entrenched and there was little or no motivation for the various teams to work together. Any attempts to bring the team together were seen as trying to break up the link between the individual organisation and the parent company. It was often argued, during the conduct of the research, that being connected to your parent company was important in the sense that it gave you access to a larger number of expertise. Whereas this position was justifiable and sometimes necessary, it undermined the collective and integrated approaches that are required within the project delivery team.

The introduction of organisation into the project delivery plays a significant role in the creation of a single project team operational boundary. In all the three cases, organisations are introduced into the project on individual basis. The various teams settled and continued to operate in the manner in which they were introduced individually. In Case 3, a package contractor remarked that so long as organisations are introduced into the delivery team on individual basis with no mention of other organisations, they would continue to operate as individual organisations. Integration of the various organisations into a single project delivery team would be greatly enhanced if from the very beginning of the organisations involvement in the project, they are made aware that they are part of a bigger team and would have to operate within the bigger team boundary. This is also dictated by the kind of working relationships that exist among the team and the impact on integration as discussed in Section 7.3.3 below.

7.3.3 WORK RELATIONSHIPS

The construction industry has often resorted to changing procurement arrangement as a means of improving the delivery of project. This is evident from the discussion in Section 2.3 of this thesis on project delivery. At the core of all the procurement

systems are contractual issues which all parties within the project team have to handle. This has resulted in an industry which is controlled more by contractual obligations than the core business of construction. Procurement systems also outline the formal working relationships among the various parties.

In all the three case studies, work relationships were very formal and were dictated strictly in accordance with the contractual provisions provided. There was no room in any of the cases for relationships within the work environment to be different from what the procurement arrangement required. The associated penalties that were imposed for non-compliance and non-performance meant that every organisation within the project delivery team had to follow through its contractual obligations due to obvious financial implications. True integration of teams that have come together within a short period of time can better happen when members are prepared to see beyond contractual limitations and obligations. As much as contractual fulfilment has its place in ensuring fairness and order, undue adherence can, and mostly create problem within an environment where no single party has the answer to all the queries that may be raised. It undermines trust and break down cordial relationships among the various parties.

The duties and responsibilities of all parties involved in all the three case studies were clearly spelt out both at the organisational and individual levels. Reporting lines were clearly outlined and that reduced the number of conflicts in work sections and improved the flow of work. In Case 1, for example, site coordinating meetings were held at the close of the day with the leaders of the various package contractors to plan all the delivery expected on site for the following day. This ensured that all delivery were timely and did not affect work in progress or dependent activities. The meeting achieved two things in relation to team integration. Firstly, it creates a spirit of togetherness and collective team efforts among the various attendants of the meeting. Secondly, it removes the tendency to blame each other for clash deliveries, a phenomenon underlining the fragmented approach to collaborative working within the project delivery team. At the core of the coordination meeting is the issue of access to and distribution of information. This is discussed in Section 7.3.4 below.

7.3.4 INFORMATION ACCESS AND DISTRIBUTION

One of the key dimensions of integration outlined in Section 3.5.4 is access to information. This is because the project delivery team comprises different functional skills which are complementary in nature. In order to ensure that all parties involved in the delivery process are informed, as what pertains in an integrated team, information will not only have to be available but also easily accessible to all members.

In all the three cases, information was only made available to members outside individual organisations when they required it and if allowed by the terms of the contract. Access to information within individual organisations was mostly non-restricted. This further highlights the continued existence of suspicion and lack of trust among member organisations of the project delivery team. Individual approach to work still remains the order of the day at the expense of teamwork. Alignment of goals of individual organisations with the project becomes more difficult and presents a major barrier to team integration as discussed in Section 3.5.3.

Access to information takes place within the context of how the information is distributed. Two basic systems of distribution emerge from the case studies; an electronic system and a paper based distribution system. The electronic information distribution system was easily accessible and circulated information speedily. The system kept everyone involved on the project well informed and on time, however, eliminated face to face contact and interaction. This was necessary for teamwork spirit and help in integrating the team. The paper based system was slower and relied upon a robust document transmittal system to be effective. It, however, brought individuals within the various functional teams together through face to face discussion of details.

The merits and demerits of both system towards teamwork spirit and subsequently, integration, meant that the use of both systems were beneficial. When the electronic system is combined with the paper based as practiced in Case 3, information is distributed quickly but the paper based sources of information bring people on the team together to discuss issues raised on the information provided.

7.4 WORK ENVIRONMENT

Table 7.2 Cross-case comparisons of work environment

	Case 1	Case 2	Case 3
Delivery team location	- Various functional teams in separate offices with open plan office setup within individual functional teams. - Further portioning within the common construction team space. - Design team had a representative on site.	- Management operated separately from the other team with cellular plan offices. - Construction team members maintained separate offices with open plan. - The design team offices were located outside of the site.	- Management team located together with cellular and open plan offices. - Construction team located together but members maintained separate office with open plan. - The design team, except the Design Manager, was located outside of the site.
Linkage of offices	- No physical linkage between the various offices. - No dedicated telecommunication facility designed to link offices.	- No provision for physical linkage between the sites. - No dedicated systems of communication present to link the various offices.	- No provision for physical linkage between the sites. - No dedicated systems of communication present to link the various offices.
Team members' movement	- Free movement of members within an organisation. - Movement restricted across organisations.	- Restricted movement within the management team. - Movement between the various organisations were formal and restricted	- Free movement within the individual team and organisation offices. - Restricted movement across organisations.
Interaction space	- Location of common facilities allowed interaction of members within individual organisations. - No provision for interaction space for the various organisations especially within the construction team.	- Limited availability of common spaces for interaction of members within the various offices. - No provision for a common interaction space for the project team. - Various organisations provided their own common space.	- Location of changing and canteen facilities provided opportunity for non-management members to interact. - No provision for common interaction spaces within individual teams and for the project.

7.4.1 DELIVERY TEAM LOCATION

The co-location of the project delivery team has been found in a number of past research findings and reports as a contributing factor to the integration of the team. This is because when the whole delivery team is within a common space it helps speed up the process of creating a new project team identity. Following on from this analysis, co-location and the creation of a new project identity were highlighted as a key dimension of integration in a literature based analysis in Section 3.5.4. The location of the various functional teams that make up the project delivery is, therefore, important if the team are to act as a single unit.

The pursuance of individual goals and objectives that has created the much criticised fragmentation of the construction is evident in all three case studies from the setup of the various organisations that make up the project delivery team. All functional teams and organisations within the teams maintained individual office spaces and locations. The only attempts at sharing any form of common spaces were limited, where they existed, to individual organisations' set up. The delivery teams in all the case studies were clearly seen as comprising different organisations and the concept of one single project which is projected by Design and Build procurement was evidently absent. This further goes to emphasise the findings in Section 5.4.1 that within the very best environments where integration is expected to flourish, the industry still faces major challenges.

Two principal office settings were evident in the case studies. These were open plan and cellular office arrangements. Organisations that adopted the open plan system had an atmosphere of togetherness and also worked more collaboratively. The open plan setup was more favourable towards the integration of the team. Cellular office space setting, however, offered the needed privacy and allowed people to focus on the tasks that had been assigned to them.

The summary of findings from the case studies presented in Section 6.5 supports the proposition that organisations that had open plan office setup worked together better as a team and were more integrated. The absence of physical barriers psychologically helped the members of the team to move freely and interact with each other. The

atmospheres within the open plan settings were friendlier and more relaxed and led to increased interactions, which is a key factor in team integration. The downside of the open plan office setting was lack of privacy and concentrations as people often talked across the office. Those in favour of the setting, however, argued that talking across the office was an advantage as it allowed those members of the team with expertise on issues being discussed to join and contribute as and when necessary. This was evident in Case 1 where the management team had an open plan arrangement with private spaces and meeting rooms located away from the open plan offices. They, therefore, took advantage of the benefits that open plan offers towards integrated teamwork and made provisions for privacy.

In cellular plan offices, the atmosphere was formal and private. In Case 2, which had cellular office plan, the friendliness of the management team was not reflected in their setting and made it difficult for other teams to work freely within their office space. The setting did not favour integrated approach to working and any attempts at collaborative working had to be consciously engendered. Members of the teams were used to their office space and tended to stay within the space. The impression given was that of everyone working individually. The setting promoted individualism, an approach that the construction industry has been trying to change to collectiveness and collaboration through integrated effort.

The absence of the Design team from site also affected the collectiveness of the project delivery team. This confirms findings in Section 5.4.2 that team integration is influenced by the procurement approach. All the three case studies had the design team novated to the Design and Build contractor and the design continues to work from their location away from the site. The rest of the project delivery team on site always viewed the design team as not being part of the team. The actions of the design team members were more of consultants than part of the project delivery team. That did not help them integrate into the project team. There were also no attempts from the Design and Build contractor to bring them to site. The presence of the design team was kept to a single representative (in Case 1) or regular site visit by the Lead Architect and Lead Engineers. Their visits were also filled with meetings and did not have any time to be part of the project team through informal interactions

which has been discussed in Section 7.2.2 as important to the integration of the project delivery team.

The above discussion underlines the difficulties faced by project delivery teams in bringing all the teams together under a single location. One of the ways of ensuring some togetherness when the project team is faced with site space restriction is to provide some form of linkage through a dedicated system of communication among the site operatives and between the various professions. The issue of linkage of the various sites are discussed in the next section (7.4.2)

7.4.2 LINKAGE OF OFFICES

Availability of space has sometimes been blamed for the separation of offices of the project delivery team members. In Cases 1 and 3, the site restrictions meant that all the teams could not be put together within a common space even if that was intended and planned. The project team locations were consequently split to allow sizeable numbers within the available spaces within the various locations. The situation was very different from Case 2 where space was not a problem and yet the offices were located in different locations.

The argument being put forward within this thesis is that the locations of the project team offices could be split due to space restriction but there should be a comprehensive system to link them. This ensures that though the various teams are differently located due to space restriction, the sense of togetherness that is necessary for integration is not lost among them. At the core of this argument is effective communication. Linking the various offices will ensure that they all communicate to arrive at decisions that are beneficial to the project and the participants. This is necessary to build trust and transparency within the team which is required to tackle the "blame culture" which has often been blamed for the poor performance of the construction industry. Overcoming the tendency has also been identified as one of the dimensions that teams that have achieved full integration exhibit as discussed in Section 5.3.3.

Findings from the case studies indicate that none of the projects investigated had no dedicated system of communication between the various office of the teams and organisations that make up the project delivery team. All systems in use combined both formal and informal systems and that often led to instances where some of the members claimed not have seen or paid due attention to mails that required urgent response. The overall effect was poor communication among the various teams and this was often capitalised by some of the teams when they fail to deliver. The presence of a dedicated system of telecommunication is also necessary to ensure uninterrupted access to the project team members. That creates sense of together and ensures that issues are discussed more often than written. This is very important if the various teams are to work as a single unit and allow the various members to move freely within and across organisations. The issue of team members' movements are now discussed in the next section (7.4.3).

7.4.3 TEAM MEMBERS' MOVEMENT

One of the ways of engendering a sense of belonging in order to create a synergetic atmosphere among the various organisations and individuals that come together to form the project delivery team is through the removal of any restriction on movements. This is often achieved through spatial planning and office allocations within the project team work environment. The two basic planning systems in use were discussed in the previous section (7.4.2). This section looks at the issues or factors that impede or facilitate team members' movement and how they influence the integration of the team in line with the key research questions posed in Section 1.4.

In all the three case studies, there were free movements within individual teams' settings. Those settings were consequently more suited to integration as they improved the sense of togetherness among the various members. The level of transparency through the removal of suspicion was also enhanced. This was achieved through the setup which allowed members to move freely within the office space without undue formal processes. The free movement assured other members that there was nothing suspicious going on within the office environment.

Movement of the project team members were restricted across organisations. All the three case studies operated a formal system of accessing other organisations' offices. This created a sense of "them and us" situation which did not help them integrate as a single unit. It was observed that the teams were comfortable with the movement restriction and never did anything to break down the barriers imposed on the team members' movements. It speaks of an industry that is very comfortable working alone and in a fragmented manner. This impacted on the level of interactions that occurred across the various teams. The availability of space for interaction and other related issues that impact on the integration of the project delivery team are discussed in the next section (7.4.4)

7.4.4 AVAILABILITY OF INTERACTION SPACE

The construction office environment is often tense and there is very little time for people within to interact with one another to get to know themselves. This builds trust and reduces suspicion and blame within the work environment. The concept is related to social capital which hinges on the benefits that is accrued from getting to know each other more and more within any working space. Spatial planning has been used to encourage people within the same working environment to interact.

The locations of the office printing and copying equipment, hygiene facility and reception areas in all the three case studies were such that the members within individual office spaces interacted in one way or the other with another member. Though the times for interaction were in some cases, limited and short, the opportunity existed for the team to improve relationships with each other. The availability of space for interaction has become important due to the increasing importance of the concept of social capital at the work place. This concept hinges on the level of interaction and the subsequent amount of trust and confidence in one another is becoming important. It is based on the fact that the more people interact with each other the better they get to know and then trust each other. The concept is very important to integration which seeks to bring people from different backgrounds together. Whereas the availability of social capital alone will not integrate the team, the concept has an influence on the cultural make up of the team which is discussed in the next section (7.5).

7.5 TEAM CULTURE

Table 7.3 Cross-case comparisons of team culture

	Case 1	Case 2	Case 3
Skills sharing and transfer	- No formal scheme available for both sharing and transfer of skills. - Opportunities existed for informal learning on the job.	- No system in place to engender skill transfer and sharing among the various organisations. - Training scheme available within the management team for young engineers.	- Regular site training for all members of the project team, especially on health and safety. - Availability of training schemes within the construction management team.
Collective sense of achievement and responsibilities	- The use of team reward scheme system. - Group responsibility for sections of work.	- Collectiveness limited to individual functional teams. - Sectional approach to work employed to engender teamwork.	- No clear indication that the whole project team worked together as a single unit. - High sense of collectiveness within sections of work.
Working attitudes	- Friendlier atmosphere within individual organisations. - Readiness to work together among the various organisations for mutual benefits.	- Senior management has a strong but cooperative attitude with all other members of the project team - Practical and on-site approach to problem resolution.	- Individual organisations and team focussed on their area of operation. - Collaborative efforts in areas where operations are interdependent and contractually obligatory.
Informal relationships and mutual respect	- Every member organisation and individual treated as important. - Availability of channels to seek redress. - Common sharing of site facilities without any distinctions. - Provision for informal/social functions.	- Project team leadership viewed as autocratic and inflexible by some members of the construction team. - Respect and recognition for the professionalism of all teams and their members. - Avenues provided for contribution by all members of the project team.	- Project team leadership encourage and fostered good informal relationships among the various members of the project team. - Every member was treated as a professional with specialist input into the project. - Provision for informal functions.

7.5.1 SKILLS SHARING AND TRANSFER

Construction projects, as discussed in Section 2.2.4, are complex and require a number of specialist skills for its execution as highlighted in Section 2.3. Consequently, construction project environments have been described as multi-skilled and multi-functional requiring the coordinated efforts for effective performance. The fragmentation of the construction industry has been attributed to the presence of these different functional skills that are needed in any single project.

The high team performance stage of team development, discussed in Section 3.3.2, is also characterised by flexibility of roles which can be achieved through the sharing and transfer of skills. This reinforces the position that effective integration is enhanced when the complementary skills are shared throughout the team. Roles are interchangeable and the absence of individuals, usually for short periods, does not affect performance of the team significantly.

The absence of formal skill transfer schemes was evident in all the three case studies. This underlines the lack of importance attached to training and development within the industry on project sites. Opportunities existed for some form of skill sharing and transfer through "learning by doing" on the job from observation and questioning. This option was flawed and often led to imperfections in the overall performance of the project delivery team. The learning process involved seeking explanations on how certain functions were performed and then performing those functions and tasks when the opportunity arises.

The only form of training observed on all the cases was limited to health and safety. This was in Case 3, where specialists were brought in to train the construction team members. The training sessions were well patronised and focussed and that is a good indication that training would be welcomed if introduced. Though the training sessions were organised by the senior management, they did not participate. That did not help in creating a sense of togetherness within the whole project team and worked against its integration.

and build (see section 2.3.2.2) which meant that the design team was more likely to see itself as the lead team. Control of the various teams was, therefore, key to ensure that the attitude of one functional team does not break apart the whole delivery team. In all the three cases the design team, with the exception of the Design Manager, was not based on site. Case 1 had a permanent representative but all issues were still resolve within the various design team members' offices.

Two distinct control systems that emerged from the case studies were centralised (in Case 1) and decentralised (Cases 2 and 3). Whereas a centralised system ensured that all activities had a common reference point, it also became a disincentive if it was used unnecessarily to control the rest of the team and negatively influenced innovations. A decentralised system ensured that all sections of the team had total control of what activities within the section. It encouraged collective responsibility and reduced blame culture which were all key for the effective integration of the project delivery team within the boundaries of operations which are discussed in the next section (7.3.2)

7.3.2 OPERATIONAL BOUNDARIES

Project teams come together for a relatively short period of time as highlighted in the introduction to this research (Section 1.1). Increasingly, it is becoming difficult for organisations that come together to form the project delivery team, to completely dissociate themselves from their parent organisations to form a new project team. The continued operation within individual organisations implies that instead of having one operational organisational boundary, you have a multiple of boundaries. This confirms earlier findings of the exploratory interview discussed in Section 5.4.1 and in contrast to the concept of team, teamwork and integration discussed in Chapter Three of this thesis.

In all the cases investigated, individual organisations operated within their boundaries. There were no efforts or attempts to integrate their operations into one single unit. This underlines the existence of fragmentation within the construction industry highlighted in Section 3.5.4. The industry is, therefore, not enjoying the full benefit of bringing together different complementary skills required to deliver the

7.5.2 COLLECTIVE SENSE OF ACHIEVEMENT AND RESPONSIBILITY

At the core of the concept of integration is the coming together of individuals to perform a task that cannot be performed efficiently and effectively by the individuals acting alone. They collectively become responsible for the performance of the task and consequently stand to benefit from any rewards. The construction industry has been described as a "teams industry" (see Section 3.5) because of its reliance of various skills. An effective team is characterised by a high collective rather than individual output (see Section 3.3.4). This implies that an effectively integrated team should have a strong sense of togetherness both in responsibility and achievement.

Rewards systems within the construction industry are geared towards individual organisations rather than the project team. This is because of how projects are procured (through individual competitive selection of project team members) within the industry, discussed in Section 2.3. There are, therefore, no rewards for team performance and even when the procurement system is integrated, rewards are structured towards individual teams that come together through a competitive selection process to deliver the project.

Findings from the case studies indicated that there were no indications of collective responsibility. Every team ensured that its interest was protected, especially, in financial terms. There was no incentive for them to act together even when the procurement system in use suggested collective responsibility. This opens up the argument as to whether procurement systems alone can improve the integration of the project delivery team. This confirms findings from the exploratory interview in Chapter Five that integration is influenced not only by the procurement system but also the practices within the team.

One strategy (observed in Case 3) that was used to create a collective sense of responsibility and achievement was the allocation of complete sections of the project to teams to deliver. The teams worked together better and had a better sense of togetherness. Integration within those teams was higher but it did not translate into the overall project.

7.5.3 WORKING ATTITUDES

Total cohesion is one of the key requirements of an effective team, discussed in Section 3.3.4, and this is achieved in a relaxed atmosphere where members are comfortable with each other and trust is high. Sharing is supported in such a working environment and members of the team are able to resolve problems better due to the availability of diverse skills and expertise. Members become more creative and are not scared to be proactive as mistakes are accommodated. The team integrated better when such an atmosphere prevails.

The various functional teams in all the three case study projects worked in a friendly atmosphere. They supported each other and often went beyond their formal sphere of responsibility to help other members of the team without explicit financial or other similar rewards. Teamwork spirit was very high and they worked together as a team with a common purpose and goal. They made every effort within their team to work in a supportive manner which helped them to integrate better.

It was observed that there was general willingness to create an atmosphere of friendliness across the various functional teams. These attitudes were pursued within contractual limits and for mutual benefits, especially in interdependent areas of operations. This underlines an industry in which working attitudes are depended on financial motives and the fulfilment of contractual obligation. Integration of teams that operate within such an industry, especially in the construction project environment, will involve a change in attitudes and perceptions to focus more on the need to complement and co-operate with each other to deliver an acceptable project to the client. What was observed during the research was more of a focus on the consequence of failure and attempts by the various teams to minimise its impact, especially financial, if they should occur.

In Case 2, the management team employed a "hands-on" approach to problem resolution and that created friendlier atmosphere among the various organisations within the construction team. They worked more closely on-site anything there was the need to resolve a problem. This was done on organisation basis and did not spread across the whole construction team. This emphasises the problem of

introduction of new organisation into the project team highlighted earlier in Section 7.3.2. Integration was easier to achieve when teams worked together and more difficult when there was no contact.

7.5.4 INFORMAL RELATIONSHIPS AND MUTUAL RESPECT

Findings from the exploratory interviews in Chapter Five indicated having fun during the execution of construction project was an effective way of reducing stress and improving the level of trust and comradeship among the various participants. Conscious efforts are often made to organise social activities and function that have the sole aim of allowing people to get to know one another outside of the work environment.

All the teams investigated in the case studies made provisions for regular social functions. They used them as a means on relaxation, helping the community in which they worked and to provide an opportunity for the members of the project delivery team to get to know each other outside the formal environment. It was hoped that as the team members get to know each other they will continue to relate in a more informal work on the project and break down some of the barriers created through working with people you are not familiar with. It was observed that members within an organisation or those that occupied the same office space continued their informal relationship but not across other organisations and teams.

Traditional procurement system, as discussed in Section 2.3, is the most fragmented system and project teams that work within such procurement environments would be most fragmented. However, it was shown in Project H in the exploratory interviews in Chapter Five that treating all the members of the project team as professional led to a more integrated approach to project delivery. This is because it gave every member confidence and increased their sense of belonging and togetherness. Consequently, working together as a team became easier and enabled them to collaborate better. All members of the project delivery team in all the case study projects were treated as professionals. There was no sense of inferiority among the various functional teams and organisations. The contributions of all members were seen as important to the delivery of the project. This observation was consistent with

the literature based analysis of the various dimensions of integration identified in Section 3.5.4 and presented in Table 3.6.

7.6 SUMMARY OF FINDINGS AND IMPLICATIONS

Two types of functional organisational structures emerge from the case studies. These were tall and hierarchical structures which distanced the senior management and made integration difficult and a flat and direct structure that facilitated integration. All the team had appropriate leadership style and maintained either a centralised or decentralised control system. The various organisations were introduced individually into the project team and continued to operate within their organisational boundaries. They related with each other only on contractual basis and were clear with their roles and responsibilities on the project. Access to information was easy within the various teams but restricted to "as needed" basis across teams. Information was distributed through electronic means which reduced face-to face interaction or through a robust or paper based system.

The various teams and organisations were located in separate offices on the project site. The design team was based outside of the project site and only had a representative on site or visited regularly. They used open plan office arrangement, which facilitated team integration but reduced privacy or cellular arrangement which gave the members privacy but did not help integration. The offices, separated due to space restriction, had no physical and dedicated telecommunication system to link them. Members move freely within their own teams and organisation but were restricted to formal movement across teams. Spaces for interactions were available within individual teams and organisations but no provisions were made for common spaces within the overall project environment.

There were no formal schemes in place for skills to be shared or transferred and that affected the flexibility of roles which is a characteristic of an effective team. Opportunities, however, existed to allow training on the job. Collective responsibility was absent from the site as all teams and organisations pursued their individual interest, largely, due to contractual obligations and financial considerations. The working atmosphere within the various teams was friendly and there was the

willingness to create similar atmospheres across teams, especially in areas where there were interdependent activities and the teams could gain mutually. This willingness could not be translated into realities as the teams focussed more on the consequence of failure and its implications. This affected the levels to which they were willing to collaborate. Attempts were made at fostering informal relationships among the members of the delivery team through social functions. The various teams and organisations that comprise the project delivery were all treated as professional and respected each other.

The above summary of findings from the case studies suggests that good practices exist within project team that enhance their integration but they have not been captured for study and improvement. The prevailing situation as observed in the case studies and analysed in Section 7.5, is that project delivery team work without due recognition of the fact that current practices within the team can help them integrate and improve their performance in the delivery of projects.

The findings also imply that there is no one way of integrating the project delivery team. All the key issues identify have an impact on each other and any attempts at resolving one raises problems or concern with another. The issues that affect team integration are all interrelated. The uncoordinated and unstructured approach that has been in practice within the project delivery environment explains the absence of fully integrated teams.

A framework is proposed in the next chapter (Eight), which lays out the relationships between the three keys issues of integration that have been identified in Sections 7.3, 7.4 and 7.5 and summarised in Section 7.6. The framework provides a structured approach in the form of pointers to draw the attention of project team leaders/managers on the issues that need consideration in the integration of their teams.

CHAPTER EIGHT – FRAMEWORK DEVELOPMENT, VALIDATION AND DISCUSSION

8.1 INTRODUCTION

Chapter Five concluded that the team integration is influenced by practices within the team and the procurement system in operation. Three projects procured through Design and Build options, which provide the ideal environment for the project delivery team to work in an integrated manner, were selected for further study. The findings of the three live case studies were presented in Chapter Six. This was followed in Chapter Seven by a cross-case analysis of the findings to identify key issues of integration within the project delivery team.

This chapter presents the development of a framework for the integration of the project delivery team. It discusses the need for the framework and presents the overview and components of the framework. The validation of the framework is also covered in the chapter which concludes with a discussion on how the framework can be implemented and the implications for its usage.

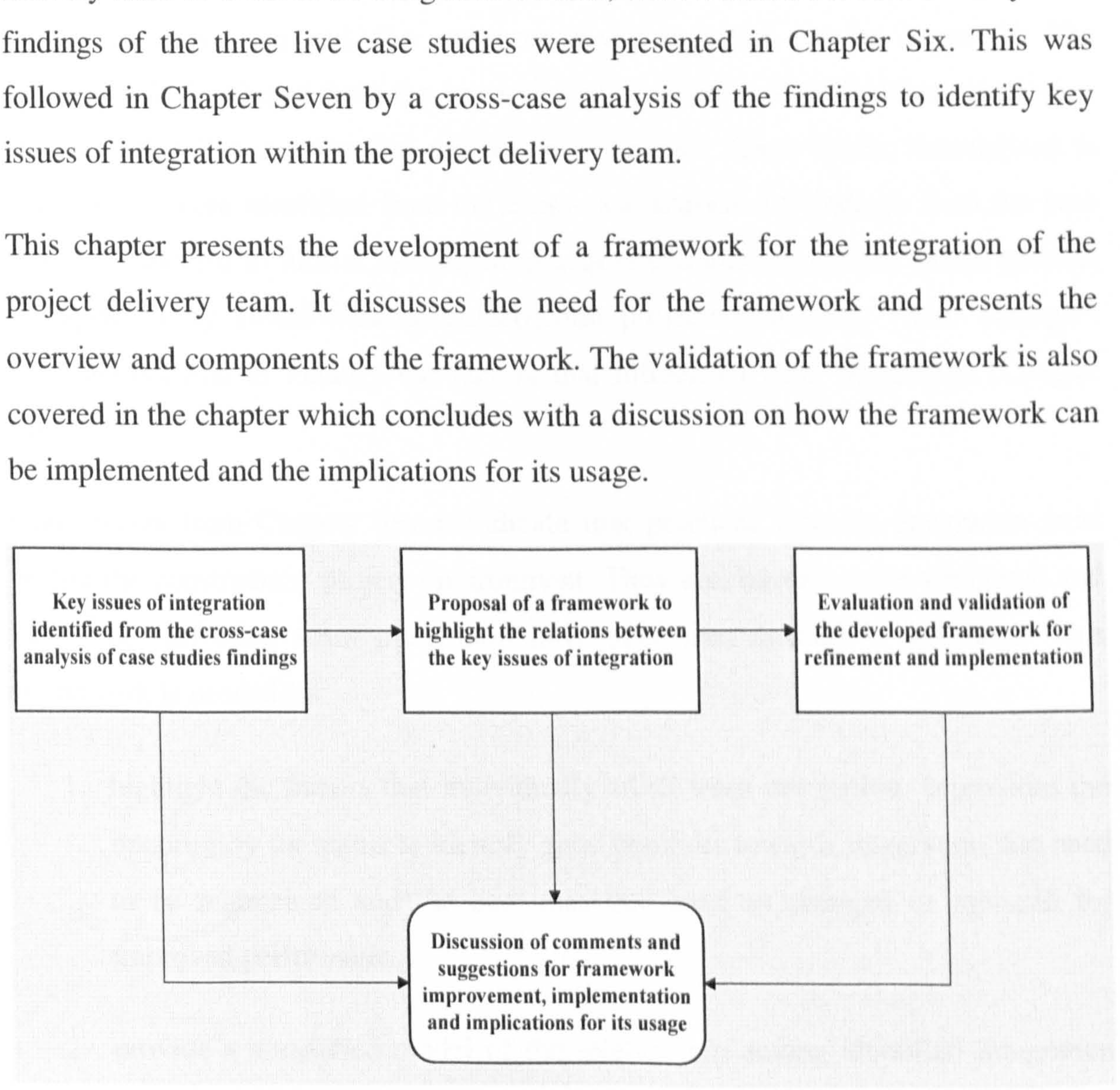

Figure 8.1 Framework development process

8.2 FRAMEWORK DEVELOPMENT

The development process of the framework has been outlined in Figure 8.1. This section discusses the need for the framework (Section 8.2.1). An overview of the framework, which focuses on its development and components, is presented in Section 8.2.2.

8.2.1 THE NEED FOR THE FRAMEWORK

The framework is proposed in this thesis to address the key research questions posed in Section 1.4 in order to achieve the aim of the research developed in Section 1.5.1. Consequently, the framework outlines the factors that influence the integration of the project delivery team and also proposes how integration can be improved. The framework is developed from the key issues of integration identified from three case studies within live construction project environments. These issues, summarised in Section 7.6, were identified from the cross-case analysis of findings from the case studies conducted to further investigate practices towards integration within projects management by award-winning construction projects managers. These managers were interviewed to identify the factors that influenced team integration (Chapter Five).

Conclusions from Chapter Seven indicate that practices towards integration exist within the construction project environment. They are, however, not structured and key issues affecting team integration have also been tackled in isolations. This framework is needed to:

1. highlight the factors that individually affect team integration. It provides the opportunity for teams to identify good practices towards integration that need to be maintained and the bad ones that have to changed or replaced for improved performance.

2. provide a simplified model of the relationship among identified integration factors so that team leader/manager will be able to refer to it when building or further developing their teams in future projects;

3. provide a set of pointers or guide as to what the keys issues are on team integration and how they are interrelated or otherwise within the construction project environment; and.

4. provide a basis for team that have already been formed to assess how integrated they are and implement corrective actions based on the provisions of the framework to improve

8.2.2 FRAMEWORK OVERVIEW

The framework present a holistic picture of all the issues that influence and affect the integration of the project delivery team. The framework comprises the following three main components.

1. Inputs factors – practices by the project delivery team toward integration;

2. Contextual factors – the context within which the study was conducted which vary from project to project.

3. Output factors – those factors that confirm the present, achievement and the extent of team integration.

The various components of the framework are presented in Figure 8.2 below.

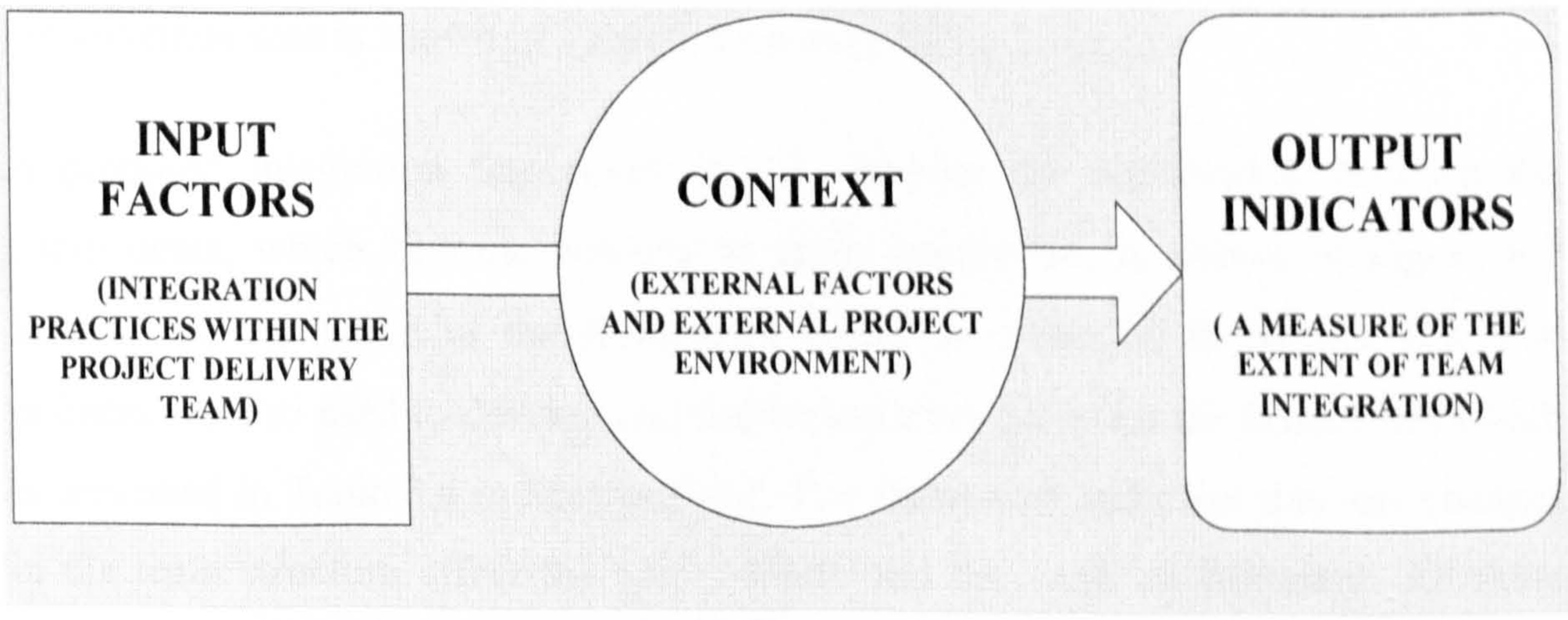

Figure 8.2 Framework components

The input factors collectively indicate "how", "where" and "why" the project delivery team works. The factors, which were identified from case studies as issues affecting integration comprise the following.

1. Structure and process.

2. Work environment.

3. Team cultures.

The contexts within which the case studies were conducted and typify project delivery environments include the following.

1. Specific contract provisions.

2. Size, complexity and duration of project.

3. Project stakeholders.

4. Specialist works and packages

The output indicators show the extent of team integration and how they can be assessed using the integration matrix developed within this research and shown in Table 3.7 on page 116. The assessment can be complemented with the teamwork effectiveness matrix shown in Table 3.5 on page 105.

A proposed integration framework model showing the relationship between the components, which become pointers to team integration, is shown in Figure 8.3 below. The validation of the framework model is presented in Section 8.3. The pointers are also used to develop and implementation guide for the framework which is presented in Table 8.4 in Section 8.4.2. The framework indicates that any changes in the team structure affect the team culture and the work environment. All these happen within a particular context and collectively affect the integration of the team. The most effective way of address integration, therefore, is to comprehensively

resolve in an interdependent manner the team structure and process, team culture and work environment. None of the input factors should be considered in isolation.

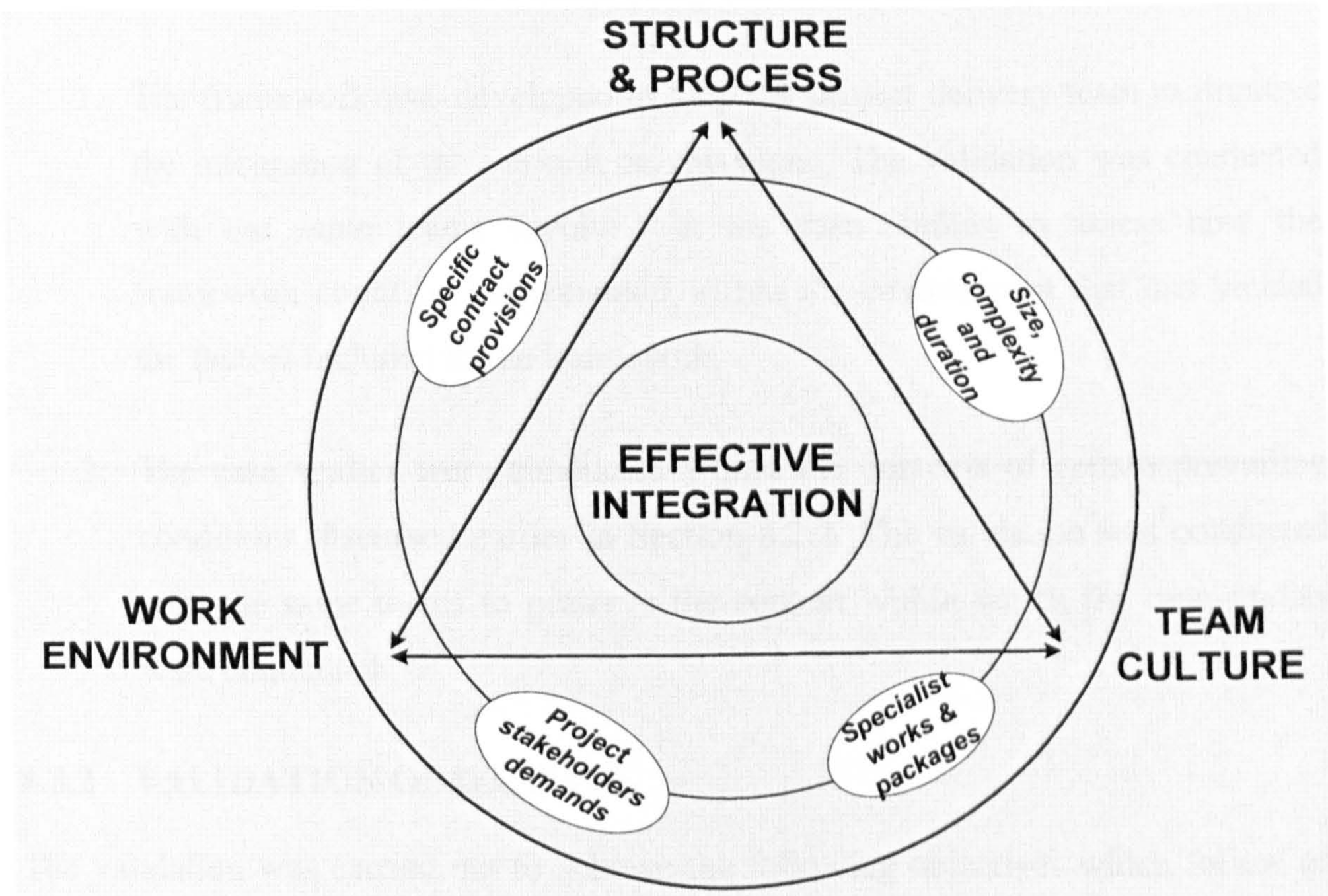

Figure 8.3 Integration framework model

8.3 VALIDATION

The approach to validation was briefly discussed in Section 4.6 and this section details out the purpose (8.3.1), objectives (8.3.2) and the process (8.3.3) used. The respondents (8.3.4) and results of validation (8.3.5) are also presented in this section. The results form the basis for the framework discussion and implementation guides presented in Section 8.4.

8.3.1 PURPOSE OF VALIDATION

The case studies unearthed a number of practices within the various project delivery teams. These practices were captured under three main themes that constitute the components of the framework. The framework that was developed was then aimed at providing a solution to how the teams can be integrated more effectively.

The purpose of the validation was to let the teams explored determine whether the factors identified in the study correctly reflect the prevailing practices. The validation was limited to the teams involved in the study due to the following reasons.

1. The framework was developed to help the project delivery team to improve the integration of the various organisations. The validation was conducted with the same teams involved in the case studies to assess how the framework could be implemented within the environment that had yielded the factors included in the framework.

2. The case studies were conducted within the contexts of certain prevailing conditions discussed earlier in Section 8.2.2. The validation was conducted with the same teams to preserve the context within which the case studies were conducted.

8.3.2 VALIDATION OBJECTIVES

The validation was carried out to achieve the following objectives which follow on from the key research question in Section 1.4.

1. Confirm or otherwise, whether the team leaders agreed with the findings made within their team and the project which are presented in the integration model.

2. Gather opinions on factors that characterise effective integration within the project delivery team.

3. Assess on the basis of (2) whether their current practices were towards integration or fragmentation.

8.3.3 VALIDATION PROCESS

Responses to the validation of the framework follow three main forms and in each case the objective is to find out whether the findings or impression formed by the researcher are congruent with the respondents (Bryman 2004). These include:

- presentation to each participant in the research process with details of interviews or observations made on the participant in the course of the research;

- feedback to a group or organisation with the impression or findings on a group or an organisation during the study by the research; and

- feedback to a group or organisation with writings based on a study of that group or organisation.

The validation process was carried in three phases described below.

Phase 1

Preliminary findings on factors that affected the integration of the project delivery team were presented to the leaders of the various functional teams (respondents). They were asked to indicate their level of agreement with the factors identified.

Phase 2

Respondents were then asked to rank two sets of factors representing good and bad practices towards integration within the project delivery team. The factors were benchmarked against those identified earlier by the respondents as affecting integration. This was to enable them assess the extent of integration within the delivery team according to what the respondent see as best practice.

Phase 3

The respondents were then presented with the framework for improving integration within the delivery team. The participants reviewed and commented on the framework developed in the research to assess:

- the completeness of the framework in dealing with all the issues that prevented effective integration;

- the appropriateness of the framework and the ease with which it can be implemented; and

- the willingness of management to implement the concepts in the framework in future projects.

The validation employed the use of the Likert uni-dimensional scales because it is less laborious and ensures that all items measure the same thing (Oppenheim 2003). An attitude continuum for each statement in the validation was constructed as described below.

Strongly agree – respondent had no doubt on the certainly of question being asked.

Agree – respondent generally agreed with the issue or principle underlying the issue being questioned.

Uncertain – respondent was not sure but cannot confirm or deny the importance of issue under discussion or being questioned.

Disagree – respondent did not agree with the issue or the principle underlining the issue being discussed or questioned.

Strongly disagree – respondent was completely aware that the issue under consideration was not possible from his/her perspective.

Details of the presentation and the questionnaire used for the validation are included in this thesis as Appendices B and C respectively.

8.3.4 LIMITATIONS AMD IMPLICATIONS

The method of validation chosen in this research allow for validation within the original sample that was used to identify the key issues affecting the integration of the project delivery team. The results, therefore, have immediate relevance to the teams that were involved in the study and do not infer wider industry application. The chosen method closes in on the sample used in the validation process and further validation would have to be conducted to ascertain the applicability of the results within the wider industry.

Results from the validation process provide the teams studied with an effective approach to integration within their context of operation. The application of the concepts and issues highlighted in this research must, therefore, be applied within context. Another implication of the methods chosen is that future project delivery teams can be studied to identify solutions that would help them integrate better within their particular operational context.

8.3.5 RESPONDENTS

The validation of the framework was conducted through workshop organised with the target group (see Section 1.5.2) of the research. The respondents also participated in interviews conducted during the case studies to understand the operations and other observed activities within their respective teams. They used questionnaires which addressed the following issues.

1. Effective integration characteristics.

2. Integration framework model assessment.

3. Project team integration assessment.

4. Assessment of integration practices on their current project site.

The first two sets of questionnaire were designed to address the key research question under investigation. The remaining two helped the teams who participated in the case studies to determine the extent of integration within the current project team environments. Details of the respondents are provided in Table 8.1 below.

Table 8.1 Details of validation questionnaire respondents

	CASE 1	CASE 2	CASE 3
Position of respondent in project delivery team	Project Director (1A)	Project Manager (2A)	Project Director (3A)
	Project Manager (1B)	Construction Manager (2B)	Project Manager (3B)
	Construction Manager (1C)	Project Engineer (2C)	Service (M & E) Manager (3C)
	Design Manager (1D)	Design Manager (2D)	Design Manage (3D)

8.3.6 VALIDATION RESULTS

Table 8.2 Validation results on effective integration characteristics

EFFECTIVE INTEGRATION CHARACTERISITICS		1 strongly disagree & 5 Strongly agree													
Questions		**Respondents' score**												**Average**	
		1A	**1B**	**1C**	**1D**	**2A**	**2B**	**2C**	**2D**	**3A**	**3B**	**3C**	**3D**	**Score**	**%**
STRUCTURE & PROCESS														**4.3**	**85%**
1	Flat and direct organisation structure with senior management in contact with team members.	5	5	5	4	4	5	5	4	3	4	4	4	4.3	87%
2	A new project team identity without boundaries and separate from individual organisations.	4	5	5	4	4	4	4	4	4	3	3	2	3.8	77%
3	Clearly defined work relationship among the teams in control of manageable work sections.	5	5	5	5	3	4	5	5	4	4	4	4	4.4	88%
4	Free flow of and access to information and documents within the project team.	4	5	5	4	5	4	5	5	4	4	4	4	4.4	88%
WORK ENVIRONMENT														**4.1**	**81%**
5	Multidisciplinary and multifunctional teams are sited within a single location.	4	5	5	4	4	3	4	3	4	5	4	4	4.1	82%
6	Connected office locations of teams when they cannot be together due to space restrictions.	4	5	5	4	4	4	4	5	4	4	4	4	4.3	85%
7	Unrestricted access and free movement of members and the availability of private spaces.	5	5	5	4	3	4	2	4	4	4	4	2	3.8	77%
8	Communal spaces to engender informal interactions among project team members.	5	5	5	3	3	4	5	3	4	4	4	4	4.1	82%
TEAM CULTURE														**4.4**	**89%**
9	Sharing and transfer of knowledge freely within the project team.	4	5	5	4	4	3	5	5	4	3	4	4	4.2	83%
10	Sense of ownership, collective responsibility & achievement.	5	5	5	4	5	5	5	5	4	4	4	4	4.6	92%
11	Collaborative and non-confrontational working attitudes.	4	5	5	5	4	5	5	5	4	5	4	4	4.6	92%
12	Good informal working relationships and respect for all project team members as professionals.	4	5	5	5	4	4	5	5	4	4	4	4	4.4	88%

Table 8.3 Respondents' assessment of integration framework model

A	INTEGRATION FRAMEWORK MODEL ASSESSMENT	1 strongly disagree & 5 Strongly agree													
	Questions	**Respondents' score**												**Average**	
		1A	**1B**	**1C**	**1D**	**2A**	**2B**	**2C**	**2D**	**3A**	**3B**	**3C**	**3D**	**Score**	**%**
1	There is a high level of awareness of the importance of integration.	4	5	5	4	3	2	4	4	4	4	4	4	3.9	78%
2	A structured approach can help improve both awareness and effectiveness of team integration.	4	5	4	4	4	5	4	4	4	3	4	4	4.1	82%
3	The factors identified in the model can help improve team integration.	4	5	4	4	4	4	4	4	3	4	4	4	4.0	80%
4	If the key factors have previously been tackled, this has been in isolation but not in an integrated manner as shown in the model.	4	3	4	3	4	3	4	4	4	3	5	2	3.6	72%
5	The integration framework model is easy to understand and follow.	3	3	3	3	4	5	4	3	4	4	4	4	3.7	73%
6	The relationships among the factors in the model are clearly understood.	3	5	4	3	4	5	3	4	4	4	4	4	3.9	78%
7	The issues and strategies presented in the model are familiar.	4	5	4	4	4	4	4	3	4	3	4	4	3.9	78%
8	The model provides a basis for future research into the measurement of team integration.	4	5	3	3	4	4	3	3	3	4	4	4	3.7	73%
9	The model can be easily implemented without much training.	4	4	4	4	3	3	4	3	5	3	4	3	3.7	73%
10	Senior management will be willing to commit to using the model on projects.	4	4	3	4	4	3	3	3	4	4	3	4	3.6	72%
	Overall assessment													**3.8**	**76%**

Two sets of results are discussed within this thesis to address the key research questions posed in Section 1.4. The first set, presented in Table 8.2, deals with the identification of factors that affect the integration of the team. The second set of results, presented in Table 8.3, is an assessment of the proposed integration framework model. The discussion and implications of the validation results are now presented in Section 8.4.

8.4 DISCUSSION OF FRAMEWORK

The developed and validated framework is now discussed in the following sections to highlight some of comments and suggestion made during the exercise for improvement (Section 8.4.1). An implementation guide is then presented in Section 8.4.2 to help prospective project team managers/leader to improve the level of integration within their teams. Finally, implications for the use of the framework are discussed in Section 8.4.3.

8.4.1 COMMENTS AND SUGGESTIONS FOR IMPROVEMENT

Results from Table 8.2 indicate that the respondents agreed with the various factors identified by this research as characterising an integrated team. The integration framework model was also acceptable to the respondents. The level of acceptance of the model was, however, slightly lower than that of the characteristics of an integrated team.

In the opinion of the respondents the framework adequately unearthed the key issue and factors that have to be tackled within the project team that is determined to deliver a high level performance. They also acknowledged that the practices suggested, that characterise an integrated team, were already in place. All that needed to be done was to ensure that they are properly structured for effective implementation. This is where they found the framework useful as it does not introduce any new technique but identifies familiar practices that can be geared towards effective team integration.

The responded concluded that the construction industry is currently saddled with a number of reports and initiatives. Senior management has consequently become tired of testing and implementing more techniques. They were of the view that though the framework provided a useful means to enhance the performance of the project team through integration, it would take time for its full implementation. They agreed that the model was easy to follow and could be implemented without any excessive training. An implementation guide that provides the details of process and procures in an easy-to-follow manner would be useful

Table 8.3 Framework implementation guide

	WORK ENVIRONMENT	STRUCTURE & PROCESSES	PROJECT TEAM CULTURE	CONTEXT & INFLUENCES	INTEGRATION ASSESSMENT
Overview	**Determination of project team physical working environment.**	**Setting up of inter and intra-team processes and strategies.**	**Engendering the creation of a project team culture**	**Identification of context and external influences on project**	**Assessment of integration and teamwork**
Objective	*To determine appropriate physical environment for the project team to operate as a single unit*	*To set up structures and procedures to facilitate collaborative working practices within teams*	*To encourage and manage the members towards a common project team culture*	*To identify contextual nature of project and external influences on the project team.*	*To assess the extent of integration and the level of effectiveness of teamwork.*
Details of processes, procedures, checks and strategies	• Delivery team location. • Linkage of delivery team offices. • Team members' movement. • Availability of interaction space.	• Organisation structure. • Operational boundaries. • Work and formal relationships within the team. • Information access distribution.	• Skills sharing and transfer. • Collective sense of responsibility and achievement. • Working attitudes of team members. • Informal relationships and mutual respect.	• Specialist works & packages; • Specific contract provisions; • Size, complexity & duration; • Project stakeholders demands;	• Integration matrix to assess the extent of integration within the team. • Teamwork effectiveness matrix to assess the level of teamwork effectiveness.
Improvement target/expected outcome	• Creation of a new co-located project team. • Connected office locations. • Multidisciplinary teams within a given location.	• Project team operating without boundaries. • Free flow and access to information and personnel. • Clearly defined work relationships.	• Joint resolution of problem and sharing of blame for mistakes. • Collaborative working attitudes & culture. • Good working relationships.	• Management of all external influences on project. • Us of appropriate procurement method that encourages collaboration. • Incentives for team working.	• Highly integrated team. • High level of teamwork effectiveness. • High performance team.

The implementation guide presented in Table 8.3 outline the objective in tackling each key issue of integration. The guide further spells out details of procedure, procedures, check and strategies that are required. The expected outcome is also provided to service as a guide for assessment and correction, if necessary.

8.4.3 IMPLICATIONS

The use of the framework through the implementation guide would not instantly transform your team into a fully integrated and high performing one. It would, however, provide a significant step toward improving the performance of the project delivery team if the guide is followed carefully. Other contextual condition within which the framework operated would have to be considered. A change in these conditions is expected to influence the way in which the guide is to be implemented.

The guide has set out in a very simplified format for easy implementation and monitoring. It is sets to gradually but systematically unearth the potential integration practices within the existing team so that they can be structured toward effective integration. It is expected that project team manager/leaders who implement the framework would appreciate the complex nature of the relationships among the three key issues of integration identified in this research.

The guide is more suggestive than descriptive to make it more adaptable. The findings of the research were very contextual so the guide set out pointers to what has to be done depending upon prevailing conditions at the time of application.

8.5 SUMMARY

The chapter presented the framework which is expected to provide construction project team managers and leader within a set of guidelines that will enable them to improve the integration of their team. This is because integration had been found to lead to improved team performance. The chapter discussed the need for the framework and its development. The results of the framework validation and an implementation guide for using the framework were presented in the chapter. The chapter concluded with a discussion of the implication of the framework. The next chapter concludes on the findings for the whole research.

CHAPTER NINE - RESEARCH CONCLUSIONS AND RECOMMENDATIONS

9.1 INTRODUCTION

The main introduction to the research was covered in Chapter One. Chapters Two and Three developed the theoretical aspects and the context within which the research was conducted. In Chapter Four, methodological issues were considered and appropriate research approaches were selected and justified.

The research process was in two main phases: exploratory interviews and case studies. Chapter 5 presented results, analysis and conclusions from the first phase of the research process. Findings from case studies conducted to further investigate the prevalence of issues in the previous phase of the research were presented in Chapter Six. A cross-case analysis of findings from the case studies was discussed in Chapter Seven. Chapter Eight presented the development and validation of a framework to address the key research questions.

This chapter presents the conclusions of the study and recommendations for future research on how to improve the integration of future project delivery teams. The chapter discusses the achievement of the research objectives to highlight the contributions of the research. The main limitations of the research are also presented in the chapter. The chapter concludes with recommendations for further research that can be conducted based on the conclusions and limitations of the study.

9.2 ACHIEVEMENT OF RESEARCH OBJECTIVES

The research objectives were developed in Section 1.5.2 in order to achieve the aim of the research. Objectives 01 and 02 were achieved through literature reviews. Exploratory interviews were conducted to achieve Objective 03. Objective 04 was achieved through the conduct of three live case studies based on the conclusions from Objective 03.

The last two objectives of the research, 05 and 06, were achieved through cross-case analysis of the finding of the case studies which resulted in the development of a framework and the subsequent validation of the framework. Table 9.1 is a summary of how each of the objectives was achieved in this research.

Table 9.1 Methods of achievement of research objectives

Objective	Details of objective	Method of achievement
01	Review the performance of project delivery within the UK construction industry and improvement efforts.	Literature review of past research and industry reports.
02	Review the concepts of team, teamwork and integration for performance improvement in multi-disciplinary environments.	Literature review of the relevant concepts and the deduction of their impact
03	Identify how leading construction project managers have engendered and managed the integration of teams in large projects.	In-depth interviews of award winning construction project managers.
04	Explore effective integration of the project delivery team through the investigation of three live case study projects managed by leading construction project managers.	Use of simple observation, interviews and documentation to investigate integration practices within live case studies.
05	Develop a framework of working practices for improving the integration of delivery teams in future projects.	Cross-case analysis of findings from case studies and the development of themes
06	Validate case study findings and framework through industry-based workshops.	Testing of developed framework through questionnaires with team leaders of case study projects.

9.2.1 LITERATURE REVIEWS

Objectives 01 and 02 were achieved through literature reviews presented in Chapters Two and Three of the thesis. Details of the objectives are presented in this section of the thesis.

Objective 01 - Project performance review

This objective was achieved through the review of past literature of the UK construction industry and the main procurement processes that shape the relationships within the industry. Performance improvement initiatives by industry and their resulting reports were also reviewed.

The review highlighted the importance of the construction industry and attempts over the years to move towards integrated system of procurement. This is because of the fragmented nature of the traditional system which has been blamed for the industry's poor project delivery performance. The introduction of performance measurement frameworks within the industry to highlight demonstrable improvement in initiatives was also reviewed. The final review highlighted the challenge to the industry by successive reports to improve its performance through integrated processes and team in the delivery of projects.

Objective 02 – Review of concepts

The second objective of the research was also achieved through a review of relevant literature on the concepts of team, teamwork and integration. It follows on from the conclusions of the previous literature review that the fragmentation of the construction industry, which has been blamed for its poor performance, could be resolved through the use of integrated processes and teams.

The review established the increasing use of teams in industries similar to construction for improved performance. It emphasised that effective teamwork is required for information sharing within the team and also co-coordinating the activities of members. Integration will then be required, especially in environments where more than one functional skill exist, such as the construction project environment, to bring the various requisite to work together more effectively as a

single unit. The review highlighted the various dimension that underline the concept of integration.

9.2.2 EXPLORATORY INTERVIEWS

Objective 03 was achieved through exploratory interviews which, as discussed in Section 4.4.1, allow in-depth investigation of issues and free flow of information from interviewees. The basis for their selection has been discussed in Section 5.2.1 of this thesis. Details of the exploratory interviews were presented in Chapter Five.

Objective 03 –Team integration within large project

The third objective was met through semi-structured interviews with award-winning construction project managers. The interviews highlighted that the extent of integration within the project delivery team was dependent on the practices and was influenced by the procurement system. It also provided empirical evidence that integration could act as a means of improving teamwork.

Teams integrate better through early formation of relationship and the removal of adversarial attitudes and blame culture especially within Design and Build procurement arrangement. Construction project delivery teams still face considerable challenges in their attempt to integrate and hence the need for further investigations to highlight the practices that have to be adopted for improved integration.

9.2.3 CASE STUDIES

Three live case studies were conducted to achieve Objective 04. Findings of the case studies were presented in Chapter Six and the cross-case analysis in Chapter Seven of the thesis. The achievement of the Objective 04 is described below.

Objective 04 - Effective integration factors

Integration is more effective within individual organisations and functional teams. The case studies highlighted accessible leadership, friendly working environment, effective information distribution and appropriate structure as good practices that facilitated integration within the project delivery team. However, practices such as undue adherence to contractual details and commercial considerations were major barriers to effective integration.

Integration of the project delivery team was found to be influenced by three key inter-related issues. These were the team structure and processes, the work environment and culture. These issues have received attention but only separately and there was no structured approach in engendering an effective teamwork atmosphere.

9.2.4 FRAMEWORK

Objective 05 was achieved from the development of a framework based on the cross-case analysis of findings from case studies in Chapter Seven. Objectives 06 was achieved through the validation of the framework developed to achieve Objective 05 which takes a structured approach to the integration of the project delivery team through key issues summarised in Section 7.6.

Objective 05 - Framework development

The achievement of Objective 04 highlighted that integration of the project delivery team was influenced by three key issues. The development of the framework, set as Objective 05, was based on these three key issues.

The framework, presented in Section 8.2, outlines pointers that focus the project delivery team issues that need to be addressed to ensure that the team structure and processes are set within an appropriate work environment to influence the attitudes and behaviour of the members towards the achievement of the project objectives. The central theme of the framework is the inter-relation of all the three key issues of integration. It draws attention to the research target, presented in Section 1.5.2, on the need to be comprehensive in dealing with team integration.

Objective 06 - Framework validation

The above objective was achieved through testing the framework developed in Objective 05 to find out whether the framework developed captured all the issues that affected the integration of the project delivery team. The validation, presented in Section 8.3, was carried out through workshops with team leaders of the case study projects from which the issues were identified.

The validation workshop concluded that the framework adequately highlighted key issues affecting the integration of the project delivery team and the practices that improve integration were already in place. It also provided a sufficient basis for them to assess the extent of integration within individual organisations and the project delivery team based on the current practices and procedures. The framework was also moderately easy to understand and could improve team integration in future projects. Implementation and commitment by senior management could, however, take time.

9.3 CONTRIBUTION TO RESEARCH

The research set out to address the research questions posed in Section 1.4 and restated here:

1. ***what are the key factors that influence the integration of the project delivery team? and***
2. ***how can the integration of the project delivery team be improved for the efficient delivery of a construction project?***

This contribution of this research falls into two main categories: theory and industry and practice. Addressing the first research questions above contributes to research theory. The resolution of the second research question posed has ramification for industry and practice.

9.3.1 THEORY

As demonstrated in Section 3.5.4, there are increasing numbers of research findings on integration of the project delivery. This is in response to the call on the construction industry to move towards integrated teams and processes. The focus has, however, been on the introduction of collaborative strategies and efforts within the construction industry.

This research contributes to the body of knowledge by identifying the various factors that influence the integration of the project delivery team. This contribution is made through the development of the integration matrix described in Table 3.7 of Section 3.5.4. It describes practices that indicate the extent of integration within the various dimensions of integration identified from past research. Results from exploratory interviews also highlight the two main factors influencing the integration of the project team. These factors, as stated in Section 5.5, are team practices and procurement system. This research further contributes to theory identifying the key issues that affect team integration. These issues were used within the thesis in Section 8.2 to develop a framework of practices for improving team integration.

9.3.2 INDUSTRY AND PRACTICE

One of the key issues that this research sought to address was to explore how the aspirations of the project delivery team towards integration can be met. This is because the construction industry in the UK has limited examples of fully integrated teams. Section 3.5.4 indicates that these examples are in demonstration projects set out to highlight the benefits of integration.

This research provides industry with a sense of how widespread integration is within project delivery team in the UK. The framework developed in Section 8.2 was also based on existing practices. This gives industry the opportunity to look at their current practices and structure them to enhance the integration of teams. The issues identified in the research and used for the framework development are not sophiscated and are present within existing teams. This research, therefore, provides the industry with a simplistic and yet very effective means on team integration.

9.4 RESEARCH IMPLICATIONS

The addressing of the research questions in Section 9.3 has wider implications for the aspirations of project delivery teams within the UK construction industry. The two main implications discussed in this section of the thesis are the fragmentation of the delivery process, often blamed for its poor performance and the integration of the project delivery team in future projects.

9.4.1 FRAGMENTATION OF THE DELIVERY PROCESS

Construction project delivery, as discussed in Section 2.3.1, is traditionally fragmented. The industry has, through different procurement arrangements, attempted to remove this fragmentation by introducing integrated approaches to project delivery. Examples of such approaches were discussed in Section 2.3.2. These attempts have improved the delivery process but have not been able to deal completely with the issue of fragmentation.

Successive industry-led reports, discussed in Section 2.5, have also all highlighted fragmentation within the construction industry as a major barrier to performance improvement. The realisation of the aspirations of the UK construction industry to form integrated teams for improved project delivery has still not been achieved.

This research contributes to the debate and efforts to reduce fragmentation within the construction industry by highlighting the nature and sources of fragmentation within the project delivery team (Section 5.4). The research also highlights the key issues and the factors that need to be addressed if the fragmentation of the delivery process is to be overcome (Chapter Seven). The development of the framework for the integration of the delivery teams is also targeted at reduction or removal of the fragmentation within the delivery process.

9.4.2 INTEGRATION OF THE PROJECT DELIVERY TEAM

This research has highlighted that the project delivery team faces considerable challenges in its efforts toward integration. This research has identified the sources and nature of these challenges. This thesis proposes measures and attitudes that are required within the construction industry to overcome the challenge identified. These

measures collectively present an important step to helping teams to work in a more integrated manner and improve their performance in project delivery.

The research highlighted through the review of literature in Section 2.4.1 that traditional project success criteria of cost, time and quality must be replaced with more comprehensive measures of performance. To achieve the necessary replacement, behaviours within the industry must change to create collaborative and non-adversarial project cultures. That will then help project teams to meet a project's quality requirements at the right cost and on time. This can be argued to be a difficult task given the relatively short duration of most construction projects and the temporary and changing nature of project delivery teams. Results from the exploratory interviews in Chapter 5, however, show that if some time is allowed before the commencement of the project for individuals to get to know each other, they can form mutually agreed goals which will be carried unto the project execution phase.

If continuous improvement in project delivery is to be achieved through team integration, then there needs to be a system or means of measuring how integrated a team is and importantly, how this changes over time. The framework developed in this research gives an indication of how current practices help towards integration. If utilised regularly, the team performance can then be managed in a proactive rather than reactive way. This will ensure that teams are adequately prepared to face any challenges that will prevent them from working in an integrated manner.

9.5 RESEARCH LIMITATIONS

This research, like any other, had limitations in its conduct and scope. These limitations provide the basis for future research recommendations outlined in Section 9.6. This research had the following limitations.

- The research was limited to on-site project delivery team. It did not include the off-site head office based team with both direct an indirect influence on the performance of the on-site based team.

- The case studies, based on the findings of the exploratory interviews, were conducted within Design and Build project environment which is structured to favour the integrated working among the various organisations that make up the project delivery team. It, therefore, represents the ideal structural conditions for integration practices.

- The focus of the research was on the contractor's side of the delivery team and did not include the client's team. The influence of the client's team on the operations of the delivery team was, however, considered.

- The identification of the key issues influencing the integration of the project delivery team did not include factors outside of the team, that is, external factors. The findings of the research are, therefore, contextual and cannot apply to the construction industry as a whole. This limitation of generalisability is recognised with case study methodology.

9.6 RECOMMENDATIONS

The following recommendations, based on the limitations of the scope of this research, discussed in Section 9.4, are made for future research into the integration of the project delivery team.

- Studies to explore the extent of impact and influence of the head office based team on the integration and subsequently, the performance of the site-based project delivery team.

- Investigation into how the roles played by the client, suppliers and other members of the supply chain influence the integration of the delivery team for improved project delivery.

- Assessment of the impact of the external factors on key issues of integrations identified within the project delivery team.

- Extend research to investigate integration practices within projects procured through non-integrated systems to further highlight whether the move

towards integrated procurement system within the construction industry can resolve the problem of fragmentation.

- Examine the extent to which individual integration factors impact on each other. This will highlight importance of the individual factors on the extent of integration of the project delivery team.

- A study of the impact and role of non-management members of the delivery team on the integration.

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APPENDICES

APPENDIX A – LIST OF PUBLICATIONS

1. B.K. Baiden, A.D.F. Price and A.R.J. Dainty (2006) The extent of team integration within construction projects, International Journal of Project Management Volume 24, Issue 1, January 2006, pp 13-23 . Online at doi:10.1016/j.ijproman.2005.05.001

2. B.K. Baiden, A.D.F. Price and A.R.J. Dainty (2003) "Exploring the use of team types for performance improvement" Proceedings of the 1st Scottish Conference for Postgraduate Researchers of the Built & Natural Environment, Egbu, C. & Tong, M.K.L (Ed), Glasgow, Nov., 2003, pp 99-110.

3. B.K. Baiden, A.D.F. Price and A.R.J. Dainty (2003) "Looking beyond processes: human factors in team integration" Proceedings of the 19th Annual Conference of the Association of Researchers in Construction Management: Greenwood, D. (Ed), Brighton, Sept., 2003, pp 233-242

APPENDIX B – VALIDATION PRESENTATION

SLIDE 1

CASE STUDY FINDINGS

Framework For The Integration Of The Project Delivery Team

Researcher : BK Baiden
Supervisors: Prof. ADF Price
Dr. ARJ Dainty

SLIDE 2

Overview of presentation

1. **Research background & objectives**
2. **Case study background & findings**
3. **Research contribution**
4. **Effective integration model**
5. **Questionnaires**
6. **Open discussion & comments**

SLIDE 3

Research background

- **Clients are not satisfied with performance of the Construction Industry**
- **Project delivery is unreliable and time and cost overruns are common**
- **Project procurement and delivery process are fragmented**
- **Industry reports have suggested use of integrated teams and approaches**
- **Improvement techniques have been imposed where traditional attitudes still exist**

SLIDE 4

Research objectives

1. **Review the concept of teamwork and integration for performance improvement**
2. **Explore how exemplary project managers have engendered team integration**
3. **Explore effective team integration through live case study projects**
4. **Develop a framework for the integration of the project team.**

SLIDE 5

Case study background

- **Interviews with CMYA award winners (2000 - 2003) to explore effective team practices;**
- **Project teams exist as individually competent units within their organisations;**
- **Aspiration to work collaboratively with other teams on the project;**
- **Design and Build offered the best opportunity for the design and construction team to work together as a single project delivery team;**

SLIDE 6

Case study findings

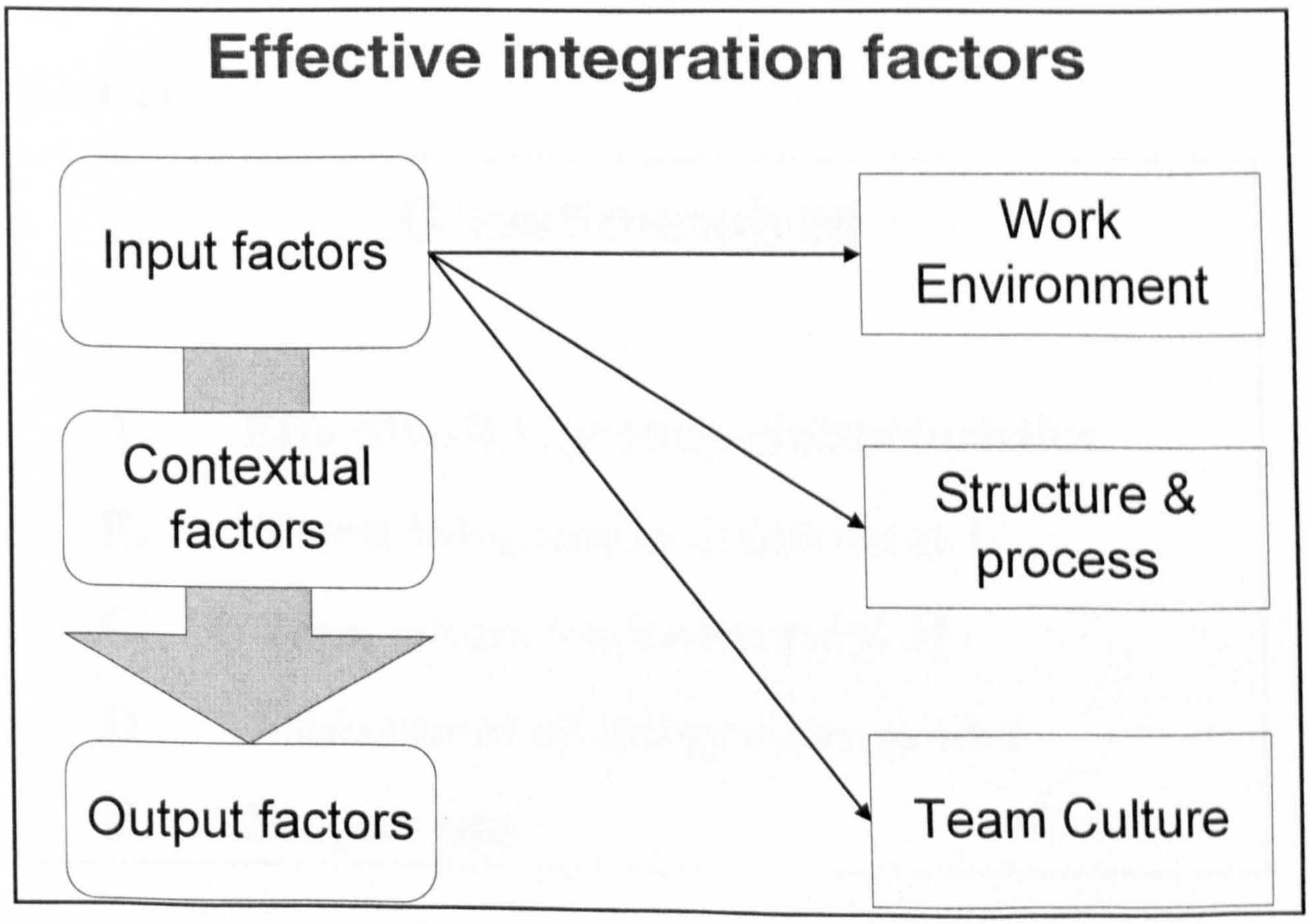
1. **Limited structured approach in integrating the project delivery team**
2. **Good and bad practices/examples of effective integration exist**
3. **Undue adherence to contractual details and commercial considerations has limited collaborative practices and integration**
4. **Key issues affecting team integration have been addressed separately and there is a no comprehensive strategy to link them**

SLIDE 7

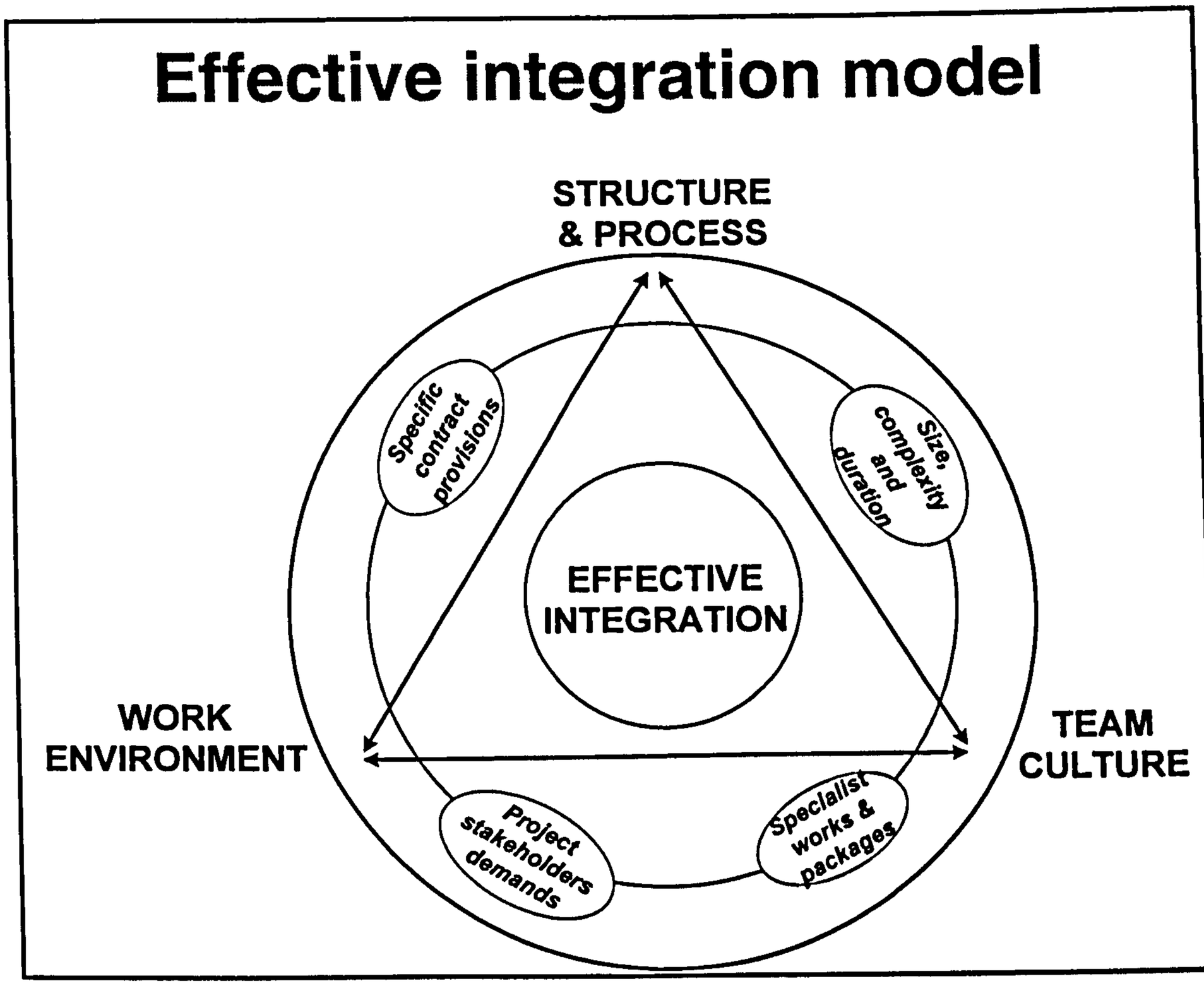
Research contribution

1. **increase the awareness of structured approach to team integration within the project delivery team;**
2. **synthesise the various familiar integration techniques and strategies;**
3. **provide a more thorough understanding of the relationships and effects of key factors that influence team integration; and**
4. **provide the basis for further research into the assessment of integration within a project context.**

SLIDE 8



SLIDE 9



SLIDE 10

Questionnaires

A. Effective integration characteristics

B. Team integration assessment I

C. Team integration assessment II

D . Assessment of integration model

E. Project site

APPENDIX C – VALIDATION QUESTIONNAIRE

A EFFECTIVE INTEGRATION CHARACTERISTICS

		Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
	STRUCTURE & PROCESS					
1	Flat and direct organisation structure with senior management in contact with team members.	☐	☐	☐	☐	☐
2	A new project team identity without boundaries and separate from individual organisations.	☐	☐	☐	☐	☐
3	Clearly defined work relationship among the teams in control of manageable work sections.	☐	☐	☐	☐	☐
4	Free flow of and access to information and documents within the project team.	☐	☐	☐	☐	☐
	WORK ENVIRONMENT					
5	Multidisciplinary and multifunctional teams are sited within a single location.	☐	☐	☐	☐	☐
6	Connected office locations of teams when they cannot be together due to space restrictions.	☐	☐	☐	☐	☐
7	Unrestricted access and free movement of members and the availability of private spaces.	☐	☐	☐	☐	☐
8	Communal spaces to engender informal interactions among project team members.	☐	☐	☐	☐	☐
	TEAM CULTURE					
9	Sharing and transfer of knowledge freely within the project team.	☐	☐	☐	☐	☐
10	Sense of ownership, collective responsibility & achievement.	☐	☐	☐	☐	☐
11	Collaborative and non-confrontational working attitudes.	☐	☐	☐	☐	☐
12	Good informal working relationships and respect for all project team members as professionals.	☐	☐	☐	☐	☐

B INTEGRATION FRAMEWORK MODEL ASSESSMENT

		Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
1	There is a high level of awareness of the importance of integration.	☐	☐	☐	☐	☐
2	A structured approach can help improve both awareness and effectiveness of team integration.	☐	☐	☐	☐	☐
3	The factors identified in the model can help improve team integration.	☐	☐	☐	☐	☐
4	If the key factors have previously been tackled, this has been in isolation but not in an integrated manner as shown in the model.	☐	☐	☐	☐	☐
5	The integration framework model is easy to understand and follow.	☐	☐	☐	☐	☐
6	The relationships among the factors in the model are clearly understood.	☐	☐	☐	☐	☐
7	The issues and strategies presented in the model are familiar.	☐	☐	☐	☐	☐
8	The model provides a basis for future research into the measurement of team integration.	☐	☐	☐	☐	☐
9	The model can be easily implemented without much training.	☐	☐	☐	☐	☐
10	Senior management will be willing to commit to using the model on projects.	☐	☐	☐	☐	☐

11 Please comments on how the model can be improved if any,

C PROJECT TEAM INTEGRATION ASSESSMENT I

Indicate the level of frequency your team performs the following

		Always	Often	Sometimes	Rarely	Never
i	Organisation structure is flat and direct, allowing contact with senior management.	☐	☐	☐	☐	☐
ii	Individual organisation identities are given up for a new project team identity.	☐	☐	☐	☐	☐
iii	Work relationships are clearly defined for teams in charge of sections of work.	☐	☐	☐	☐	☐
iv	Information and documents are easily accessible and flow freely within the project team.	☐	☐	☐	☐	☐
v	Multidisciplinary and multifunctional teams are located within a single location.	☐	☐	☐	☐	☐
vi	Office locations are connected where space restrictions necessitate their separation.	☐	☐	☐	☐	☐
vii	Access to and movement of members are unrestricted and there is provision for privacy.	☐	☐	☐	☐	☐
viii	There are communal spaces for members to interact with each other in a relaxed environment.	☐	☐	☐	☐	☐
ix	Skills are shared and transfered freely within the project team.	☐	☐	☐	☐	☐
x	Project team members have a sense of ownership, collective responsibility & achievement.	☐	☐	☐	☐	☐
xi	Members of the project team work in a collaborative and non-confrontational manner.	☐	☐	☐	☐	☐
xii	All members of the project team are respected and treated as professionals.	☐	☐	☐	☐	☐

D PROJECT TEAM INTEGRATION ASSESSMENT II

Indicate the level of frequency your team performs the following

		Always	Often	Sometimes	Rarely	Never
i	Organisation structure is heirachical and senior managers are accessed through a structured procedure.	☐	☐	☐	☐	☐
ii	Orgnisations maintain their identities and work within their defined boundaries.	☐	☐	☐	☐	☐
iii	Teams have the freedom to dictate their work relationships with others on the project.	☐	☐	☐	☐	☐
iv	Information and documents are strictly confidential and can be assessed if allowed by the contract.	☐	☐	☐	☐	☐
v	Teams with similar disciplines and functions are located in a single location.	☐	☐	☐	☐	☐
vi	Offices are private spaces and are isolated/closed to preserve the level of privacy.	☐	☐	☐	☐	☐
vii	There are appointment systems for accessing members of the project team to allow focus.	☐	☐	☐	☐	☐
viii	Informal interactions are encouraged to be restricted to ing out of office hours and day-out functions.	☐	☐	☐	☐	☐
ix	Knowledge is shared and transferred within professional and organisational boundaries.	☐	☐	☐	☐	☐
x	Individual teams have their targets to achieve and work exclusively towards these.	☐	☐	☐	☐	☐
xi	Members of the project team work in strict compliance with their contractual provisions.	☐	☐	☐	☐	☐
xii	Professionals and other members of the project team are treated according to their status.	☐	☐	☐	☐	☐

E ASSESSMENT OF INTEGRATION PRACTICES ON CURRENT PROJECT

		Always	Often	Sometimes	Rarely	Never
1	Teamwork approach is on individual organisations/teams basis	☐	☐	☐	☐	☐
2	The teams on the project collaborate on contractual matters	☐	☐	☐	☐	☐
3	There are clearly defined structures to create/engender effective project teamwork	☐	☐	☐	☐	☐
4	There is a single multidisciplinary project team in any given location	☐	☐	☐	☐	☐
5	Teams are geographically dispersed	☐	☐	☐	☐	☐
6	There is a comprehensive strategy or technology to link all the teams	☐	☐	☐	☐	☐
7	A social/status gap has been avoided from the management team office set-up	☐	☐	☐	☐	☐
8	There are opportunities for informal interactions by the project team	☐	☐	☐	☐	☐
9	Project organisation structure is flat and direct and access to team leadership is easy and unrestricted	☐	☐	☐	☐	☐
10	The teams on the project are controlled and coordinated by the management team	☐	☐	☐	☐	☐
11	There is a system in place to track and control all project documents	☐	☐	☐	☐	☐
12	Individuals team are not singled out for blame and problems are resolved in an inclusive manner	☐	☐	☐	☐	☐
13	The solution to problems identified are given back to responsible team for implementation	☐	☐	☐	☐	☐
	Good informal working relationships and respect for all project team members as professionals.					
14	Office set up allows for privacy when required	☐	☐	☐	☐	☐
15	The office set up facilitate free and unrestriced movement	☐	☐	☐	☐	☐
16	Members within each team are very supportive of each other	☐	☐	☐	☐	☐